# Instruction manual

## Simrad EK60
## Scientific echo sounder system


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MAXIMIZING YOUR PERFORMANCE AT SEA

SIMRAD
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# Simrad EK60

## Scientific echo sounder system

*850-164696 / Rev.A*

## Note

Simrad AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

## Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.

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# Sections



Note!

For information on how to use the ER60 and BI60 applications, refer to the respective operator manuals.

# Remarks

## References

Further information about the EK60 scientific echo sounder system, refer to the following manuals:

- ER60 Operator manual
- BI60 Operator manual

## The reader

This instruction manual is intended for the design and installation engineers at the shipyard performing the installation, and for readers in need of the basic echo sounder theory. The information is supplied as the basis for the shipyard's own installation drawings applicable to the vessel. On completion of the installation, this manual must be kept on the vessel for reference purposes during system maintenance.

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# Document logistics

| Rev | Date | Written | Checked | Approved |
|---|---|---|---|---|
| A | 08.07.03 | RBR/LEA | AJ | LNA |
| B | | | | |
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| E | | | | |
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| Rev | Comments |
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| A | Original issue. |
| B | |
| C | |
| D | |

To assist us in making improvements to the product and to this manual, we would welcome comments and constructive criticism. Please send all such - in writing or by e-mail - to:

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# 1 SYSTEM DESCRIPTION

## 1.1 Introduction

This chapter provides a brief introduction to the Simrad EK60 scientific echo sounder.

→ *Overview, page 2.*

→ *Main units, page 3.*

→ *System drawing, page 4.*

→ *Technical specifications, page 5.*

### Important notice

*Windows 2000* and *Windows XP* are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

## 1.2 Overview

The Simrad EK60 scientific echo sounder system is designed for fishery research and incorporates the following primary features:

- The system is flexible and easy to configure due to its modular design.
- User menus, dialogue boxes and system functions are manipulated using a standard mouse or roller ball. User input is provided using a standard keyboard.
- Raw sample data and/or data for further processing can be stored on the system's hard disk (or other recordable media).
- The EK60's display has been designed with the standard Microsoft Windows® interface in mind and operation is to a large extent very similar. Getting started should be relatively simple for users familiar with Microsoft Windows® programs with basic system operation being intuitive.
- The store/replay function reduces the need for echogram printout on paper. Unprocessed transducer signals are recorded directly to the system's harddisk. During replay, signals are input into the echo sounder software as if it they where received directly from a transceiver.

## 1.3 Main units

The system can be expanded to include additional frequency channels by adding General Purpose Transceiver (GPT) units as required. Normally a EK60 scientific echo sounder system consists of:

- One or more transducers
- One or more General Purpose Transceivers (GPT)
- A Processing Unit (computer) with **ER60** and **BI60** software
- A network to transmit data

A more detailed description of these main units include:

- Split beam transducers are available at frequencies ranging from 18 to 400 kHz.
- Communication with peripheral sensors and systems include Navigation, Motion, Trawl sensor inputs, Datagram output and Remote control.
- The General Purpose Transceiver (GPT) contains transmitter and receiver electronics. The receivers are designed for low noise, and they can handle input signals spanning a very large instantaneous dynamic amplitude range of 160 dB. All targets are correctly measured and displayed.
- A twisted pair Ethernet cable connects the General Purpose Transceiver (GPT) with the computer. The distance between the computer and the GPT can extend up to 100 meters.
- If more than one transceiver is used, a small Ethernet switch is required to connect the General Purpose Transceivers to the computer.
- The majority of the echo sounder functions are implemented in software. The bottom detection algorithm is implemented solely in software with separate computation for each frequency channel.

## 1.4 System drawing

This drawing shows the basic components of a EK60 system. For additional configurations, refer to the *Cable layout* chapter.

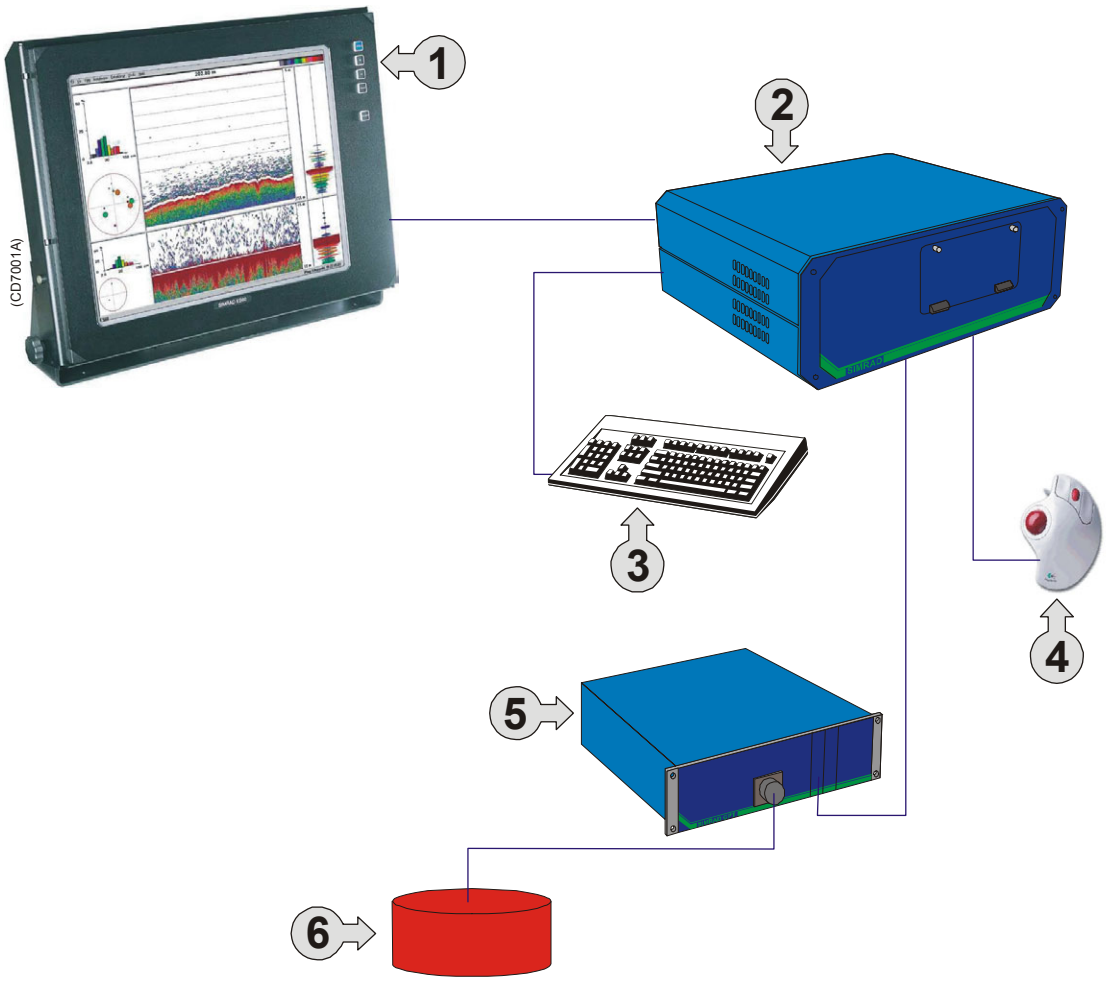



*Figure 1 EK60 Basic system diagram*

*Legend: (1) = Colour LCD display, (2) = Processor Unit (computer), (3) = Keyboard, (4) = Mouse or pointing device, (5) = General Purpose Transceiver (GPT), (6) = Transducer.*

## 1.5 Technical specifications

The following is a summary of the technical specifications for the EK60 scientific echo sounder system. Note that the specifications may be changed without prior warning.

### Operational specifications

#### EK60 Echo sounder system

- Operating frequencies: 18, 38, 70, 120, 200 kHz
- Operational modes: Active, Passive and Tes
- Transmission power: Adjustable in steps
- Ping rate: adjustable
- Maximum ping rate: 20 pings / sec
- Data collection range: 0 to 15.000 m
- Receiver instantaneous dynamic range: 150 dB
- Receiver filtering: Matched digital filters
- Receiver noise figure: 4 dB
- Split beam: Complex digital demodulation
- Synchronization: Internal and external

#### ER60 Echo sounder application

- Operating system:
  - Microsoft® Windows XP®
  - Windows 2000® (Service pack 4)
- Transceiver control:
  - Maximum seven transceivers controlled simultanously
  - Operation, Transmit power, Pulse duration, Ping rate, Data collection range
- Calibration: Built-in application
- Sensor inputs:
  - GPS
  - Heave
  - Roll
  - Pitch
  - Trawl
  - Purse seine
  - Others

- Manual input:
  - CTD data
  - Speed
- Views:
  - Echogram
  - Target position
  - Target strength distribution
  - Colour scale
  - Numerical
  - Bottom depth
  - Chart views
- Echogram view:
  - Volume backscattering strenght
  - Target strength
  - Single target
  - Virtually unlimited number of simultanously echogram views with individual settings
- Vertical range. Adjustable 5 to 15.000 m
- Horizontal time span: Ping, Time or Distance based
- Layers: Virtually unlimited number of configurable layers
- Calulation interval: Ping, Time or Distance based
- Single target detection settings: Adjustable
- Bottom detection settings. Adjustable
- Access control: Identified users with password protection
- User configuration: Save and load personal settings
- Data server: Ethernet datagram based system for remote subscription of data
- Raw data storage: Storage of complex sample data
- Processed output: To serial line or Ethernet
- Printer output: On-line printing
- Replay: Replay of previously recorded data

### Processing Unit (computer)

These are the minimum requirements for a third-party computer.

- Operating system:
  - Microsoft® Windows XP®
  - Windows 2000® (Service pack 4)

- Additional software required:
  - Internet Explorer 5.0 (or later)
  - Adobe Acrobat Reader 5.0 (or later)

## Physical specifications

### General Purpose Transceiver (GPT)

- Transmit power: maximum 4 kW
- Output protection: Short circuit and open circuit protection
- Connectors:
  - Transducer**:** 12-pin female Amphenol, Shell MS3102A-24, Insert 24-19S
  - AUI: 15-pin female Delta
  - Network: 8-pin RJ-45 socket
  - Auxiliary: 25-pin female Delta
- Physical dimensions
  - Width**:** 284 mm
  - Height**:** 112 mm
  - Depth**:** 246 mm
- Weight: Approximately 4.5 kg depending on configuration
- Supply power and fuses**:**
  - AC: 115 to 230 Vac, 50-60 Hz, 50-100 W
  - DC**:** 11 to 15 Vdc, 50-100 W
- Fuses
  - AC fuse**:** Ø5x20 mm, 2 A slow
  - DC fuse**:** Ø5x20 mm, 10 A slow or fast

### GPT Cabinet (IP55)

- Contents:
  - One or two General Purpose Transceivers (GPT)
  - Ethernet switch
- Physical dimensions:
  - Width: 400 mm
  - Height: 425 mm
  - Depth: 420 mm
- Weights:
  - With one GPT: Approximately 30.5 kg
  - With two GPTs: Approximately 34.5 kg

### Processing Unit (computer)

These are the minimum requirements for a third-party computer.

- Processor: 500 MHz
- Memory capacity: 128 Mbyte
- Hard disk capacity: 10 GB
- Graphic adapter: 32 Mb graphic RAM, 1600 x 1200 true colours, 32-bit, Dual head
- Disk drives:
  - CD-ROM Recorder
- External interfaces**:**
  - 2 x RS232 serial
  - Centronics parallel
  - Ethernet
- Optional devices for backup and data storage:
  - Tape streamer
  - ZIP disk
  - External FireWire harddisk
- Optional devices for network operation:
  - Secondary network adapter

## Environmental specifications

### General Purpose Transceiver (GPT)

- Operational temperature: 0 to +55 deg C
- Storage temperature: -40 to +70 deg C
- Humidity: 5 to 95% relative non-condensing

### GPT Cabinet (IP55)

- Operational temperature: 0 to +55 deg C
- Storage temperature: -40 to +70 deg C
- Humidity: 5 to 95% relative non-condensing

### Processing Unit (computer)

- Operational temperature: 0 to +40 deg C
- Storage temperature: -40 to +70 deg C
- Humidity: 5 to 95% relative non-condensing

# 2 HARDWARE INSTALLATION

## General

Before installation of the EK60, various technical aspects must be surveyed and documented. The following information describes the areas which must to be addressed.

### Topics



### Related topics

None.

### Definitions

The following abbreviations are used in this section:

**UTC** - Universal time (Greenwich Mean Time, GMT)

**UPS** - Uninterrupted Power Supply

**NMEA 0183** - Standardised serial communication protocol

**GPS** - Global Positioning System

## 2.1 Basic procedure

The basic installation procedure is presented here. Detailed technical information can be found in the next chapters. The applicable page references are made in the procedure.

### 1) Parts configuration

Check that you have received all the parts required for the installation; cables, connectors, brackets etc.

### 2) Transducer(s)

Install the transducer(s) and the transducer cables according to the guidelines in this manual and the drawings provided with the transducer.

### 3) Computer and display

Set up and install the computer and display. Several configurations are available, mainly because you can either order this equipment from Simrad, buy it elsewhere, or use existing hardware. Note that minimum requirements must be met.

Note

*Make sure that there is a reliable ground connection between the computer and the ship's ground.*

### 4) Processor Unit and display

Mount the Processor Unit (computer) and the display using the appropriate brackets. Connect the pointing device. Note that a keyboard and a mouse (or other pointing device) is required.

### 5) General Purpose Transceiver (GPT)

One or more General Purpose Transceivers (GPT) are required with the EK60 echo sounder. Mount the General Purpose Transceiver using the appropriate brackets. Connect the transducer cable and the power cable.

If required, install a two-wire cable to provide remote on/off control of the of the GPT(s). The "remote" end of this cable must be terminated in an on/off toggle switch.

### 5) Ethernet

A dedicated Ethernet connection must be used between the General Purpose Transceiver(s) and the computer.

**Using one GPT:** If only one transceiver is used, you need a twisted pair cable with swapped receive and transmit wires. This cable is connected directly between the transceiver and the computer.

**Using two or more GPTs:** An Ethernet switch is required if your system includes more than one General Purpose Transceiver. in this case, use “straight” ethernet cables between the computer and the switch, and between the switch and each transceiver.

Ethernet connection to sensors and other peripheral devices must be made with a second network adapter in the computer.

### 5) Interfaces

Connect navigation receiver, trawl system, heave sensor and other peripherals with serial line output to the rear of the echo sounder computer using RS-232 cables. The same information may also be accessed on the ship’s network, but your echo sounder computer must then be equipped with a second ethernet adapter.

Heave sensors with an analogue output are connected directly to the Auxiliary connector of the nearest General Purpose Transceiver (GPT). If you have more than on GPT, the sensor shall only be connected to one of them.

### 5) Synchronization

Synchronous transmission is desirable if there are several echo sounders onboard the vessel. For every echo sounder and every transceiver onboard the ship, connect the appropriate pins at the **Auxiliary** connectors together using a two-wire cable. A serial port may also be used to allow synchronization.

#### Related topics

→ *Parts and configuration, page 12.*

→ *Transducer installation, page 21.*

→ *The transducer cables, page 76.*

→ *The remote control connection is described on page 72.*

## 2.2 Parts and configurations

### Overview

The Simrad EK60 echo sounders is designed as a modular system. It supports a variety of configurations and frequency options.

While the software, the General Purpose Transceiver (GPT) and the transducer(s) must be supplied by Simrad, the computer, display, network components and peripherals may be commercial items from other manufacturers.

### Transducer

One or more transducers are included.

A large number of transducers are available from Simrad. There are several transducer alternatives for each operating frequency with different beam widths, power rating and mounting arrangements.

Refer to the data sheet and drawings deliveried with each transducer for technical specificaitons.

### Transceiver

The General Purpose Transceiver (GPT) is a small self-contained unit containing its own power supply. It operates from +12 Vdc or 115-230 Vac. The unit can be mounted anywhere on board the ship, provided that the location is dry and ventilated. Power cable and mounting brackets are enclosed.

We recommend that the GPT is mounted as close to the transducer(s) as possible.

An Ethernet link connects the General Purpose Transceiver (GPT) to the echo sounder computer. The GPT includes its own Ethernet interface, and a network interface board must be included in the computer.

### Computer and display

The EK60 computer can be any personal computer provided that the minimum specifications are met. It must run Microsoft Windows 2000© or XP© operating systems.

Any standard computer display can be used with the computer.

In a standard EK60 delivery, a customized personal computer and a LCD unit is provided.

## Printer

A printer can be supplied. Most standard off-the-shelf colour printers can be used. A standard Windows drivers is required.

## 2.3 General Purpose Transceiver (GPT)

### Overview

The GPT transceiver is a self-contained unit. It can be mounted anywhere onboard the vessel. It is recommended to mount the GPT as close to the transducer(s) as possible in order to minimise the electrical interference into the transducer cable.

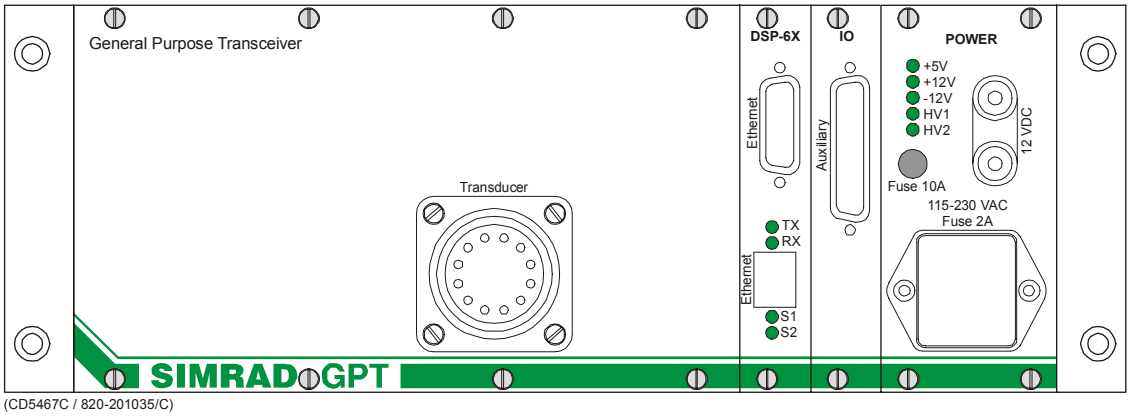



*Figure 2 General Purpose Transceiver (GPT) - front panel*

The General Purpose Transceiver is easily mounted with the brackets supplied with the unit.

### Procedure

Two brackets and four pan head screws are enclosed. The side walls of the unit each hold six screws; three screws along the bottom edge and three screws along the top edge.

The brackets can be vertically mounted in three different positions;

- Use the two rear holes, or
- Use the two center holes, or
- Use the two front holes.

The brackets can be horizontally mounted in four different ways using either the bottom edge holes or the top edge holes.

**1** Unscrew two screws from each side wall.

**2** Mount the brackets using the pan head screws.

**3** Position the unit on the surface and mark the four mounting holes.

**4** Remove the unit, and drill mounting holes.

**5** Mount the unit to the surface using 5 mm bolts.

## 2.4 GPT Cabinet

### Overview

The GPT Cabinet is a steel enclosure used to house one or two General Purpose Transceivers (GPT). The cabinet provides IP55 protection.

All electrical connections made to the cabinet are carried out on tag blocks inside the unit.


*Figure 3 GPT Cabinet*

The cabinet is easily mounted with the four brackets supplied.

### Procedure

The cabinet is fixed to the bulkhead with four bolts. Make sure that the cables exiting from the cabinet are well supported, and that enough slack is provided for maintenance.

### Cabling

All cables to the GPT Cabinet are connected through the cable glands at the bottom. The transducer cables are connected directly to the sockets on the General Purpose Transceiver (GPT) units. This means that the transducer plugs must be soldered onto the cable after the cable has been pulled through the glands.

The ethernet cable to the combined display and processor unit is terminated in a socket located on a small junction box.

All other cables are terminated onto the two tagblocks inside the cabinet.

## 2.5 Processing Unit (computer)

### Power supply

A stable power supply is necessary to provide power to the system's computer(s) and other components. An uninterrupted power supply (UPS) is recommended to supply power to the computer(s) to protect against power spikes or failure which can damage their electronic components and ability to retrieve valuable stored data.

### Computer requirements

The following information is subject to change:

- **Operative System -** Windows 2000 (SP4), Windows XP
- **Processor -** 500 MHz or better
- **Memory -** 128 MB or better
- **Hard Disk** - 10 GB or better
- **CD Station** - for software installation
- **Optional -** Tape Streamer/Zip drive/additional hard disks for backup purposes
- **Network -** Net adapter card(s) and appropriate cabling is required if computers are to be connected to a network.

### Computer location

The EK60 computer must be loacted in a dry and well ventilated room. The use of shock absorbers is strongly recommended.

Note that the maximum lenght of RS-232 cables is less than 10 meters.

### Simrad Processing Unit

A customized EK60 Processing Unit computer may be provided by Simrad. This is a ruggedized computer in a specially designed casing with solid shock absorbers.

## 2.6 Display

Any standard computer display may be used on the echo sounder computer. However, the standard delivery comprises a liquid crystal display (LCD) unit, which is available in different sizes.

A separate manual is included with each display delivery. Refer to this manual for more information about installation and use of the display unit.

# 2.7 Printer

## Introduction

Any Microsoft Windows® compatible printer may be connected to the EK60 Processor Unit. The connection is made with a standard Centronics type parallel cable.

## Hardware installation

Refer to the applicable printer documentation for hardware installation. Make sure that the printer is securely mounted to withstand the shock, vibrations and movements experienced on a ship.

## Driver installation

In order to use the printer, you must install the necessary driver(s) and set up the EK60 Processor Unit so that the presence of the printer is known. To do this, you will need to use the standard Microsoft Windows® tools on the computer.

Observe this procedure on a Windows XP computer.

**1** Terminate the echo sounder program.

**2** Press the **Start** button in the lower left corner, and activate the **Settings** option on the menu.

**3** On the **Settings** sub-menu select **Printers and Faxes**.

**4** On the next submenu, select **Add Printer**.

**5** Allow the wizard to guide you through the rest of the installation process.

## 2.8 Ethernet Data Network

The echo sounder computer and the GPT transceiver communicate via a local area network interface of the Ethernet type.

The original Ethernet version was standardised in 1978 by Xerox Corporation, Intel Corporation and Digital Equipment Corporation.

A 1/2-inch 50-ohm coax cable is used as the communication backbone medium, and a number of computers are connected to this backbone cable via a transceiver cable (15-pin Delta connector in each end) and a ”vampire” transceiver clamped onto the Ethernet coax. The communication rate is 10 Mbit/s.

Today this original Ethernet version is denoted the **IEEE 802.3 10Base5** standard. The original 1/2-inch coax is typically referred to as *thick Ethernet*, and the 15-pin Delta connector is referred to as the *AUI (Attachment Unit Interface)*. A number of variations of this technology have emerged in recent years.

By replacing the 1/2-inch coax with a thinner BNC type 50-ohm coax we arrive at the **IEEE 802.3 10Base2** standard which is commonly referred to as *thin Ethernet*.

Yet another variation is to replace the coax with fibre-optic cable.

The last variation to be described here is the **IEEE 802.3 10BaseT** standard which uses twisted pairs of wire in a star topology. This variation is commonly referred to as a *twisted pair (TP)* system. For small local area networks it is usually possible to use just one type of Ethernet, though for larger networks one often ends up with a mixed system. Transition units from one type of system to another are available from numerous suppliers.

Both AUI and TP connectors are available on the EK60 General Purpose Transceiver (GPT). A standard Ethernet adapter (plug-in board) is required on the Processing Unit computer. Typically, this board also has both the AUI and the TP connectors available.

An EK60 echo sounder system can contain more than one GPT connected to the same network cable. The echo sounder and other computer devices can co-exist on the data network without disturbing each other. If you wishto connect only one GPT to the echo sounder computer, you do not need to install a complete data network cabling system. For a minimum point-to-point link you only need a twisted pair cable where the receive and transmit wires have been swapped.

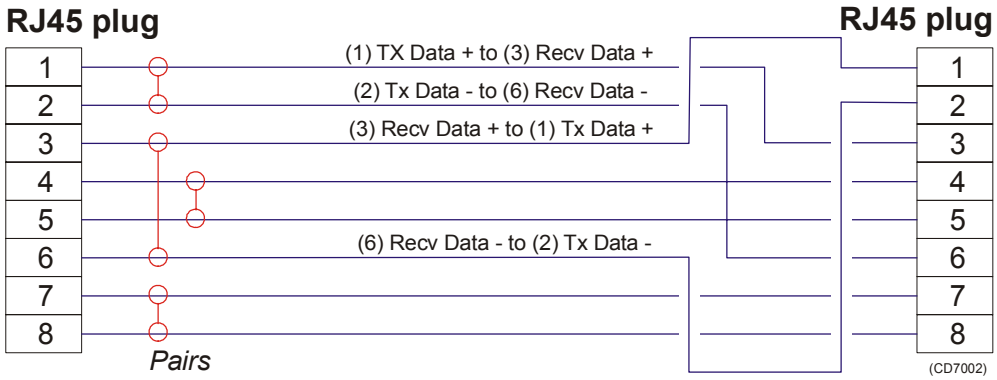



*Figure 4 IEEE 802.3 10BaseT "cross-over" cable with receive and transmit wires swapped*

- **Thick Ethernet** coax is durable and can be run through conduit and thin walls. It is relatively immune to electromagnetic interference and cross-talk. Thick coax is somewhat difficult to install, and the maximum cable length is 500 meter. A maximum of 100 Ethernet transceivers can be connected to the backbone coax.
- **Thin Ethernet** coax is cheaper than thick coax, the maximum cable length is 200 meters and a maximum of 30 Ethernet transceivers can be connected. The cable must be cut at each transceiver and a BNC T-unit used for tapping the signal. Some computers have a built-in transceiver with a BNC connector at their rear allowing the computer to be connected directly to the thin coax cable.
- **Fibre-optic Ethernet** cable is resistant to electromagnetic interference, radio interference, lightning and high voltages. It is also difficult to tap making it very secure. Attenuation is extremely low allowing data to be transmitted a distance of 2000 meters. Fibre transmission is used mostly for point-to-point connections.
- **Twisted-pair** wire is similar to ordinary telephone wire. It is inexpensive and easy to install, but is not as durable as coax. An Ethernet HUB unit is required at the central point. Available units typically contain from 8 to 32 ports.

# 3 TRANSDUCER INSTALLATION

## 3.1 Transducer location

### General

A single answer to the question where to locate the transducer cannot be given. It depends very much on the vessel's construction. However, there are some important guide lines.

### Go deep

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. In heavy seas the uppermost 5 to 10 metres may be air-filled, with the highest concentrations near the surface. Air bubbles absorb and reflect the sound energy, and may in worst cases block the sound transmission totally. Therefore, mount the transducer at a deep position on the hull.

Consider the situation when the vessel is unloaded, and when it is pitching in heavy seas. The transducer must never be lifted free of the water surface. Not only will the sound transmission be blocked, but the transducer may be damaged by slamming against the sea surface.

Another reason to go deep is cavitation in front of high power transducers. Cavitation is the formation of small bubbles in the water due to the resulting local pressure becoming negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure.

### Boundary water layer

When the vessel forces its way through the sea, the friction between the hull and the water creates a boundary layer. The thickness of the boundary layer depends upon vessel speed and the roughness of the hull. Objects protruding from the hull, and dents in the hull, disturb the flow and increase the thickness of the boundary layer. The flow in this boundary layer may be laminar or turbulent. A laminar flow is a nicely ordered, parallel movement of the water. A turbulent flow has a disorderly pattern, full of eddies. The boundary layer increases in thickness when the flow goes from laminar to turbulent. Figure 5 (next page) sketches the boundary layer of a vessel moving through the water.

Furthermore, air bubbles in the sea water are pressed down below the hull and mixed into the boundary layer. The boundary

layer is thin underneath the forward part of the vessel, and increases in thickness as it moves towards aft. If the sides of the hull are steep, some of the air bubbles in the boundary layer may escape to the sea surface along the vessel sides. It is our experience that a wide and flat bottom, with a rising angle less than around 13 degrees, is prone to giving air problems for the transducer. In any case a transducer location in the forward part of the hull is preferred in order to minimise the influence of the boundary layer.

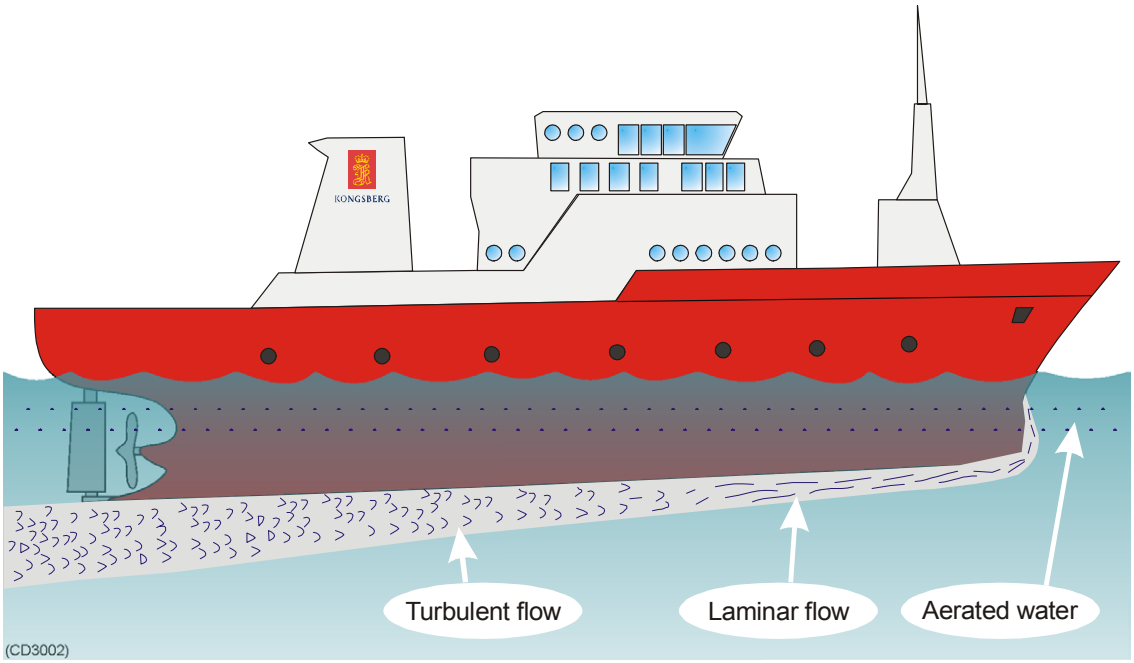



*Figure 5 Sketch of the boundary layer underneath the vessel.*

## Propeller noise

The propulsion propeller is the dominant noise source on most fishing vessels, research vessels, merchant vessels and pleasure crafts. The noise is transmitted through the sea water. Therefore the transducer should be placed far away from the propeller, which means on the fore part of the hull. Positions outside the direct line of sight from the propeller are favourable. On small vessels with short distances it is advised to mount the transducer on that side of the keel where the propeller blades move upwards, because the propeller cavitation is strongest on the other side. The cavitation starts most easily when the water flows in the same direction as the propeller blade, and that is to some degree the case at that side of the keel where the propeller blades move downwards.

Bow thruster propellers are awful machines. When they are in operation, the noise and cavitation bubbles make the echo

sounder useless, almost no matter where the transducer is installed. And when not in operation, the tunnel creates turbulence, and if the vessel is pitching, the tunnel may be filled with air or aerated water in the upper position and release this in the lower position. Therefore, an echo sounder transducer should be placed well away from the bow thruster.

## Vessel heave

Heave is the up and down movement of the vessel. It disturbs the echo traces in the echogram, so that a flat bottom is displayed as a wave. A transducer location in the middle of the vessel minimises the influence of vessel roll and pitch.

## Noises from protruding objects on the hull

Objects protruding from the hull, such as zinc anodes, sonar transducers or even the vessel's keel, generate turbulence and flow noise. Also holes and pipe outlets are noise sources. They may act as resonant cavities amplifying the flow noise at certain frequencies. Do not place an echo sounder transducer in the vicinity of such objects, and especially not close behind them.

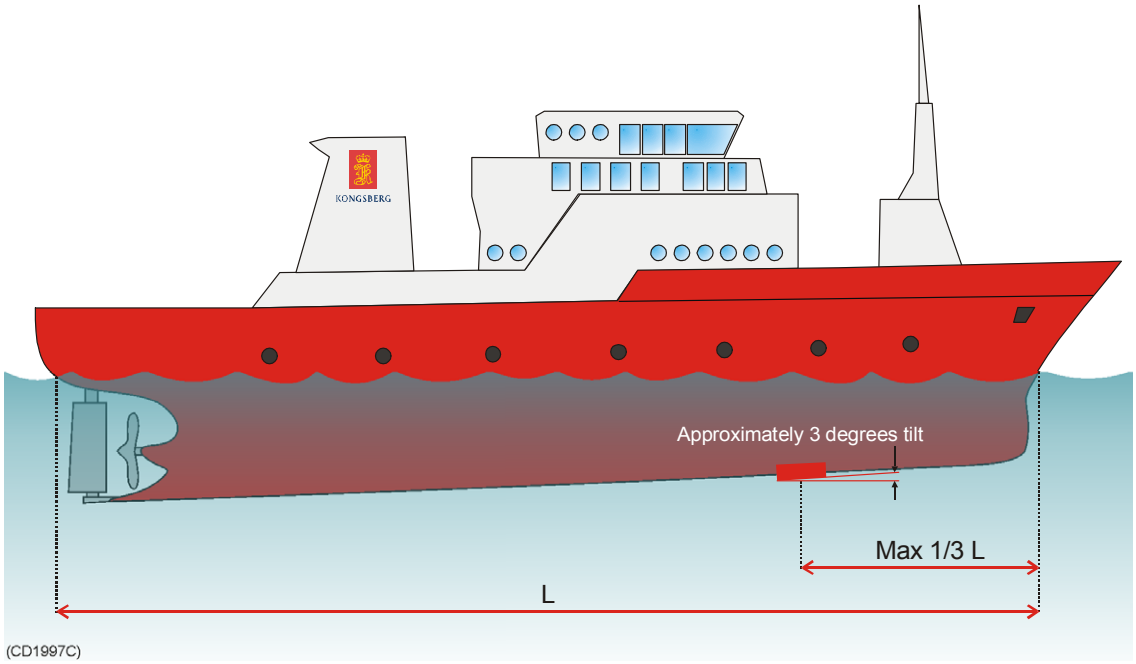



*Figure 6 Recommended location of the transducer on the hull*

## Summary

Some of the above guide lines are conflicting, and each case has to be treated individually in order to find the best compromise. Generally the propeller noise is the dominant factor, and a recommended transducer location is in the fore part of the hull, with maximum distance from the bow equal to one third of the total length of the hull at the water line.

→ *See figure 6.*

If the vessel hull has a bulbous bow, this may well be a good transducer location, but also here must be taken into consideration the flow pattern of the aerated water. Often the foremost part of the bulb is preferable.

→ *See figure 7.*

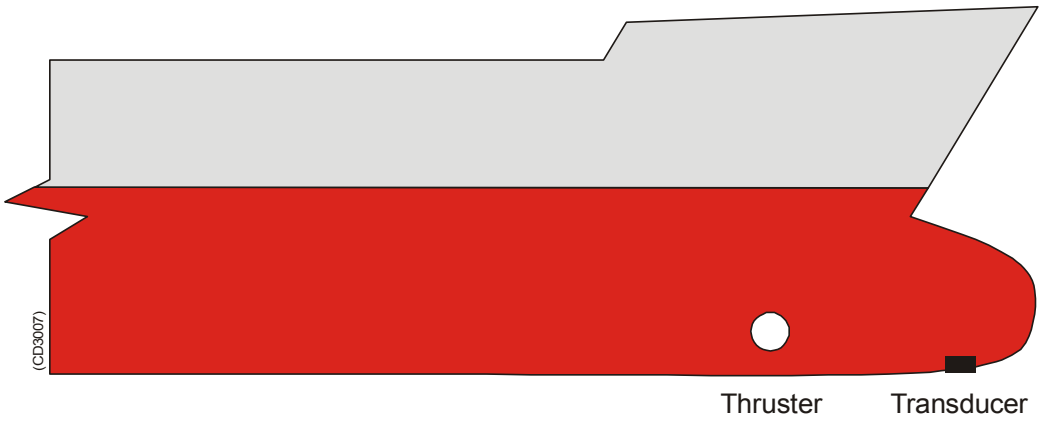



*Figure 7 Transducer location on a bulbous bow*

## 3.2 Ways of mounting the transducer

### Inclination of the transducer face

Incline the transducer face approximately 3 degrees, so that the flowing water meets it directly. This assures laminar water flow. Mounting screws should not be extruding from the transducer, and the space around the screws could be filled with a compound or a locking ring.

## External mount

Some transducers have a streamlined housing, designed for installation outside the hull.

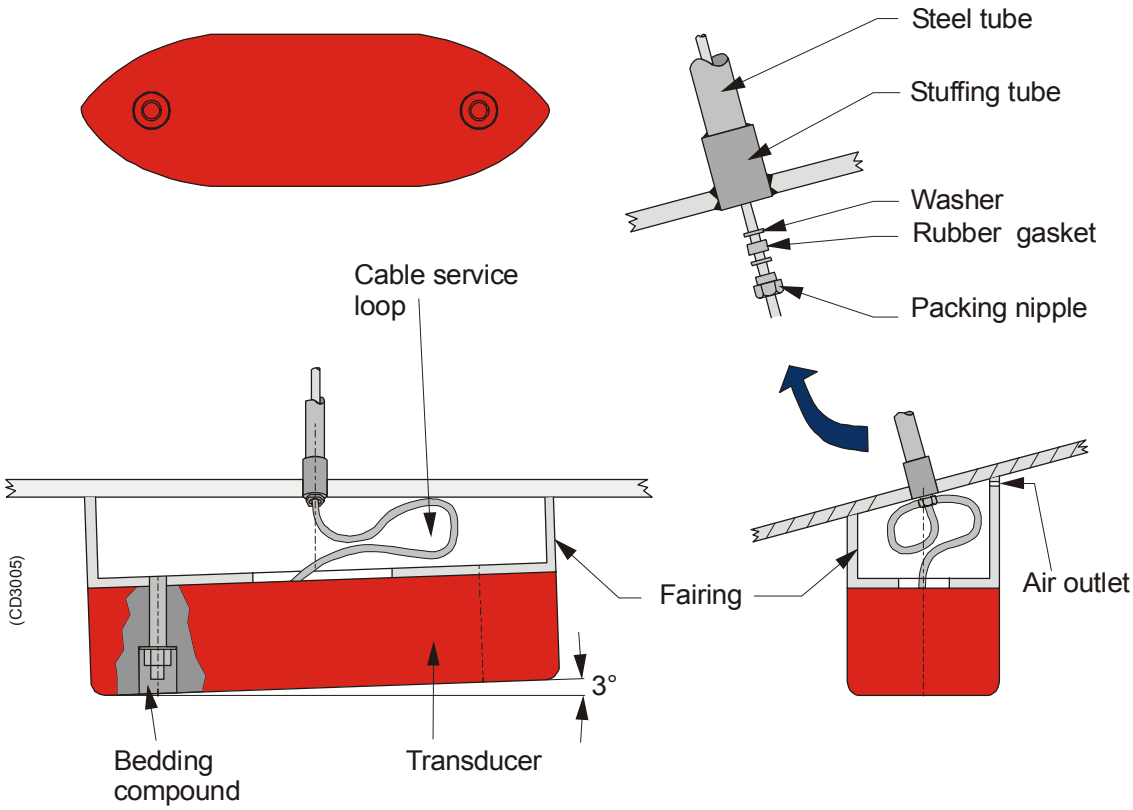



*Figure 8 External mounting on steel hulls*

A fairing, made by the shipyard, is placed between the transducer and the hull, to adapt for the deadrise angle of the hull. The fairing can be made of wood or steel, and should have the same outline dimensions as the transducer. These transducers are mainly used on smaller vessels. A location approximately 0.5 m aside from the keel may be adequate for the passage of water between the keel and the transducer. The figures above and below illustrate external mounting of transducers on steel hulls and on wood or polyester hulls respectively.

→ *Refer to figure 8 and 9.*

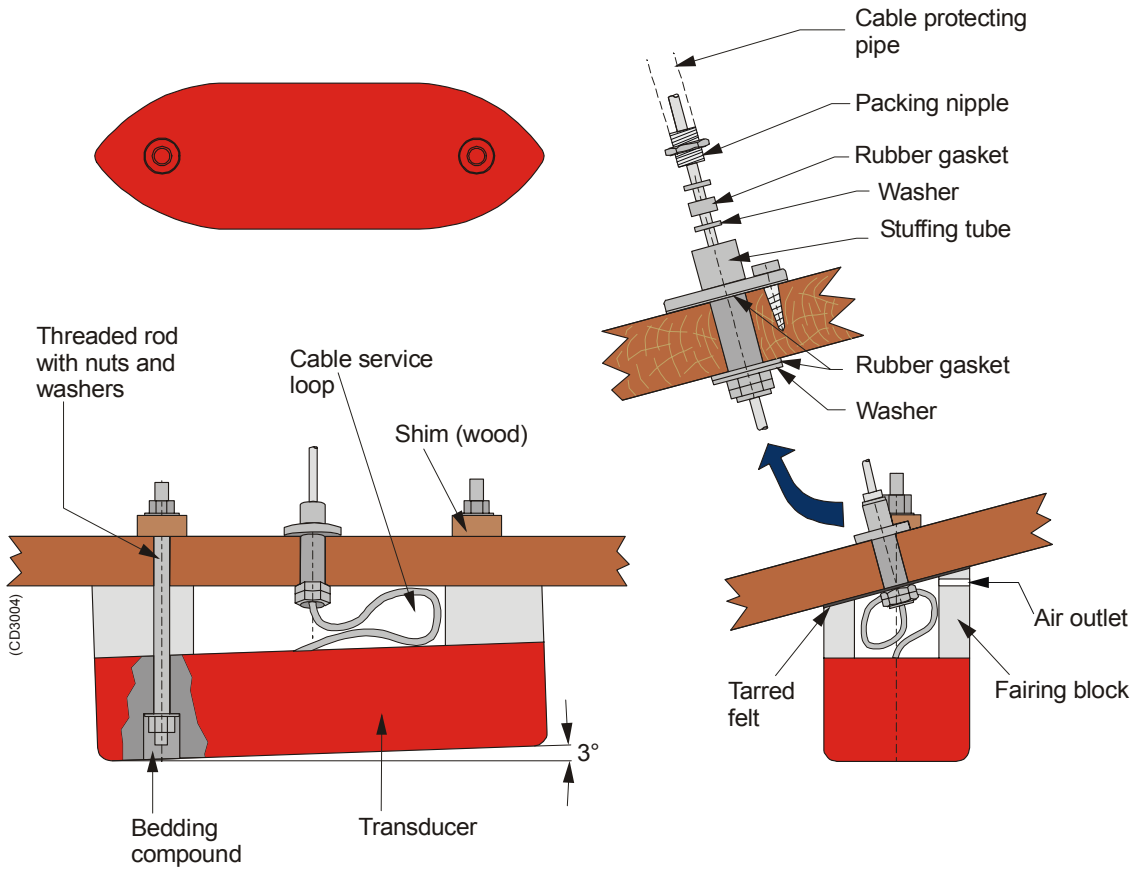



*Figure 9 External mounting on wood or polyester hulls*

## Transducer blister

Other transducers are designed for installation into the hull or in a blister. In general, a blister installation is the recommended method. It brings the transducer below the boundary layer. A blister is illustrated below.

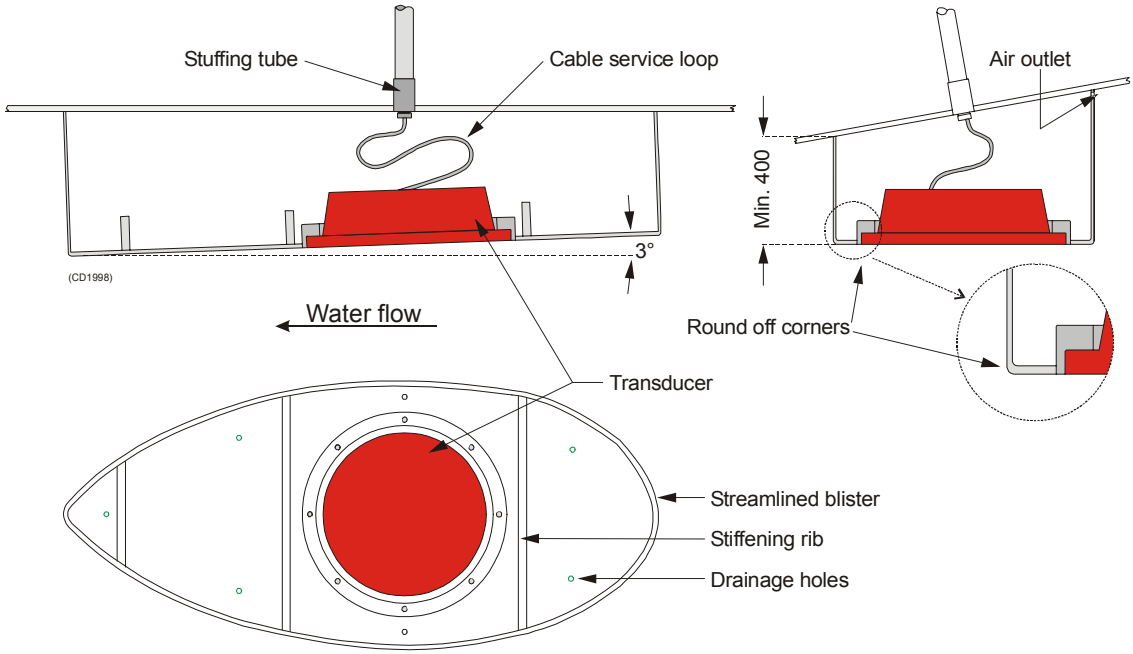



*Figure 10 Transducer blister*

The best performance is obtained with a blister height of 40 cm or more. A streamlined shape and rounded edges reduce the flow noise. A vertical leading edge or front will guide the aerated water to the sides of the blister. The orientation of the blister should follow the water flow. On a conventional hull shape, without a bulb, the front of the blister should have a few degrees toe-in towards the bow.

→ *See figure 11.*

The blister is placed on one of the sides of the hull, and the distance from the keel is a trade off between a close distance giving a turbulent flow of water in a narrow passage, and a large distance bringing the transducer higher up and also more affected by vessel roll. Normally a distance of approximately 1 m is a good compromise.

→ *See figure 12.*

The interior of the blister must be filled with sea water. Use drainage holes in the bottom and an air outlet on the top. The water pressure behind the transducer will then compensate for the outside pressure during vessel movements in rough sea.

The transducer cable penetrates the hull in a stuffing tube, see the figure above. Leave an adequate loop of the cable behind the transducer for easy mounting or removal of the transducer.

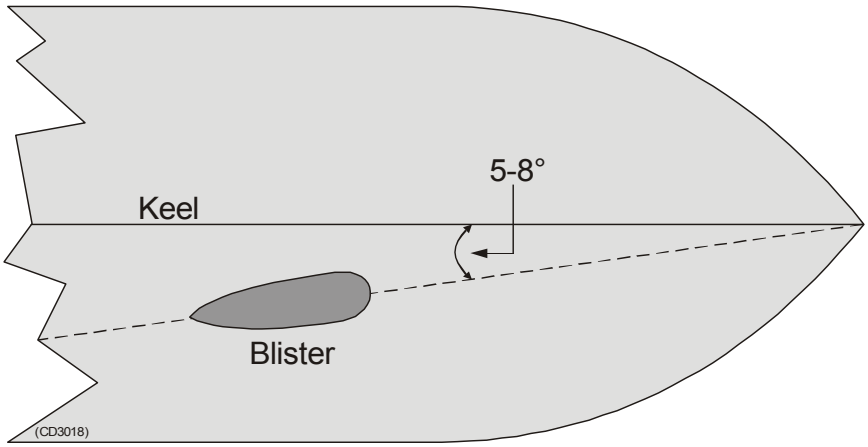



*Figure 11 Blister toe-in towards the keel*

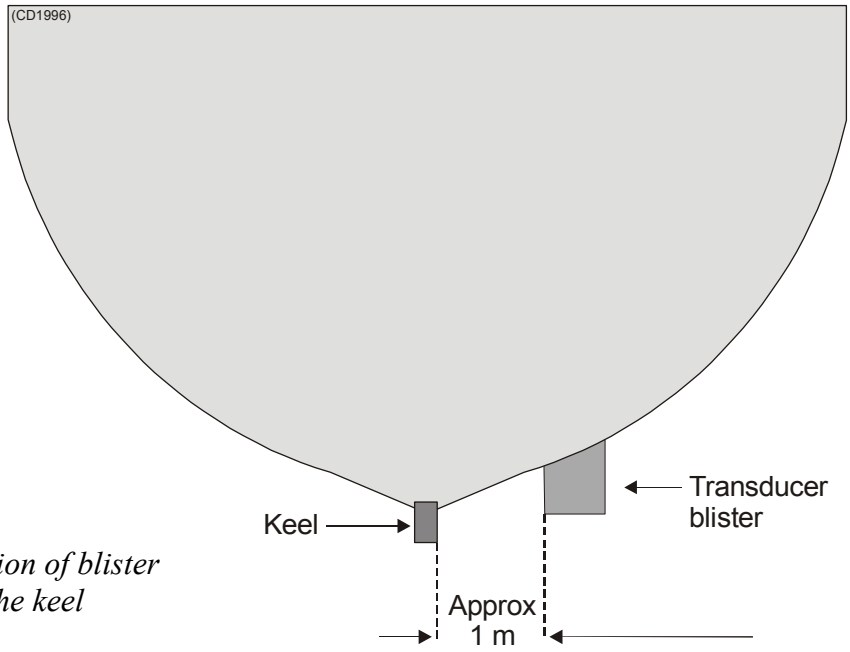



*Figure 12 Location of blister relative to the keel*

## In a box keel

Vessels with a box keel may use this for transducer installation. The box keel is already the deepest part of the vessel. If the box keel is too narrow to accommodate the transducer, it can be widened, either symmetrically or to one side only. In the last case the installation could also be described as a blister merged into the keel. The figure below illustrates a symmetrical box keel installation.

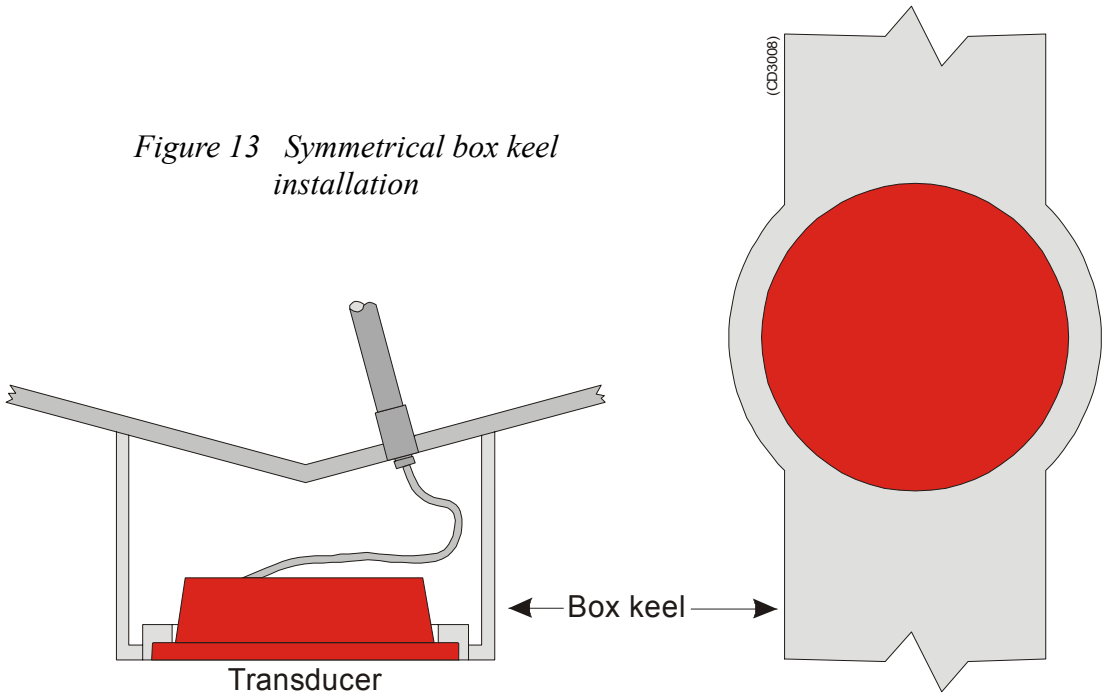



*Figure 13 Symmetrical box keel installation*

## Retractable transducer

Retractable hull units are commonly used for horizontal looking sonars. When not in use, the transducer is retracted into a trunk. The retractable hull unit is more expensive than a blister, but on vessels having a hull where it is difficult or impossible to install a blister, it may be worth-while. A retractable hull unit with transducer is shown below.

Vessels without a keel and with a wide, flat bottom is an example where a retractable hull unit can be the only acceptable method for bringing the echo sounder transducer below the boundary layer.

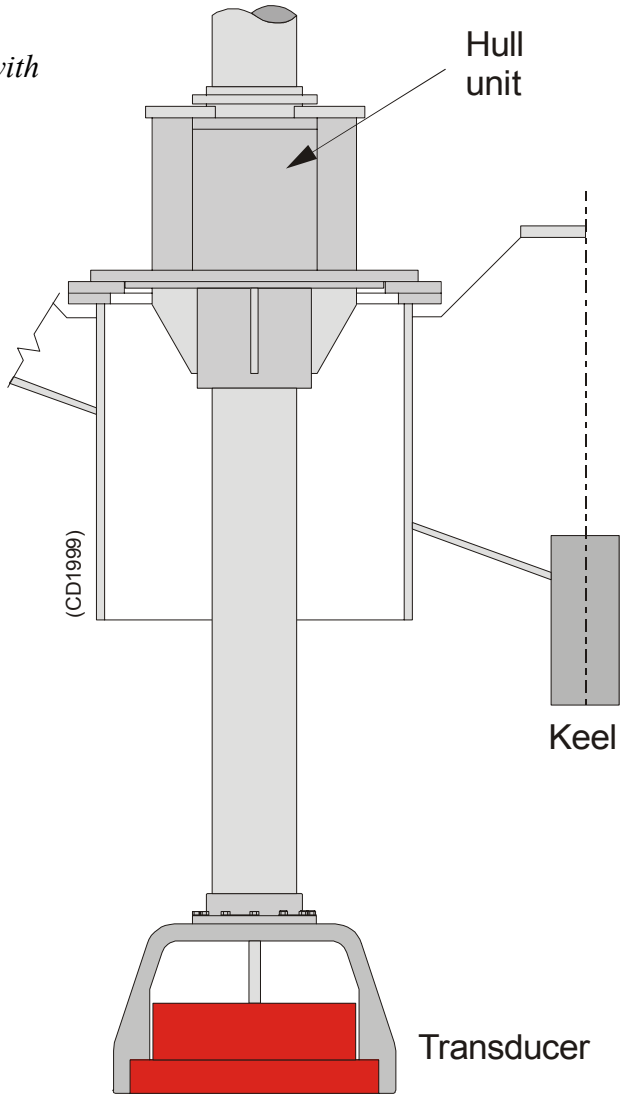



*Figure 14 Retractable hull unit with transducer*

## Centre board

The use of a centre board with the purpose of stabilising the vessel is well known. A centre board is also a superior platform for transducers. Such instrument keels have been built, mainly on research vessels,  with a length of 3 m, protruding also 3 m below the hull, see the figure below. At that depth, the water is free of air bubbles up to very high sea states. The vessel is then able to perform reliable acoustic measurements in open sea a larger part of the year.

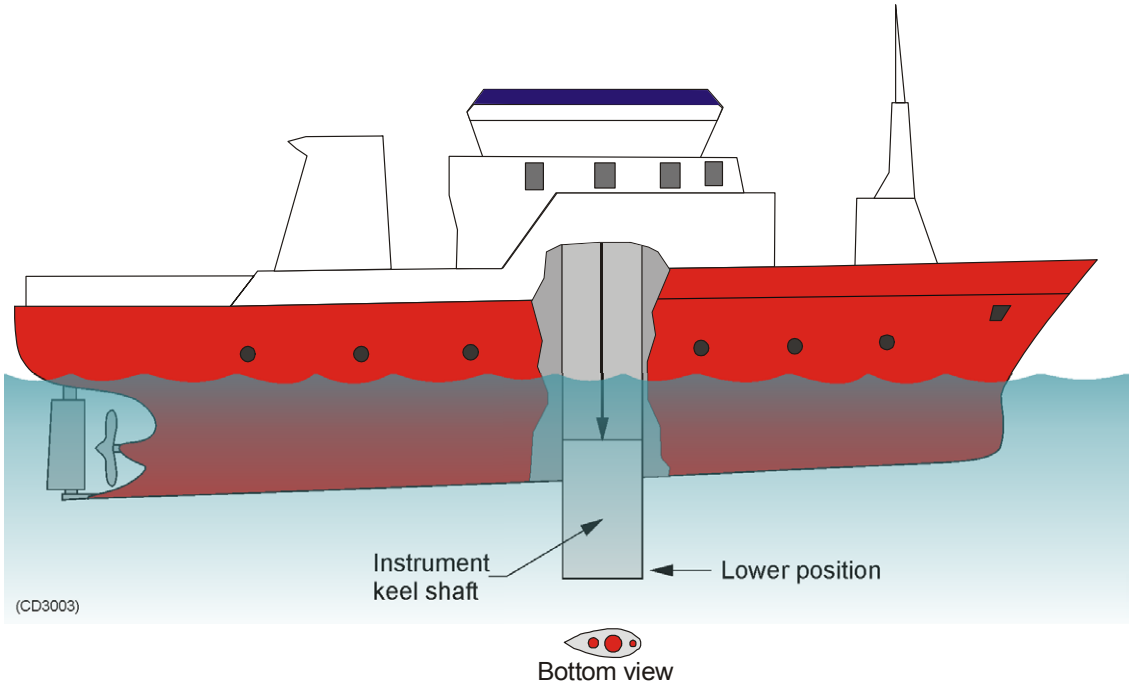



*Figure 15  Deep centre board/instrument keel*

## Flush mounting in a steel tank

Flush mounting is used on very large vessels with a hull so deep that no air bubbles are found below the hull, and on vessels operating in shallow harbours or waters, where a protruding blister can not be accepted.

The standard procedure for flush mounting on a steel vessel is to weld a steel tank inside the hull, and mount the transducer into this tank. As for a blister, the interior of the tank must be filled with water. This can be accomplished by air release through a steel tube, which is extended either to open air 1.5 m above the water line or to the water outside the hull at a point higher than the tank interior. If the tube is extended to open air, drainage must be provided with leakage at the transducer flange or a separate hole in the tank bottom. Transducer mounting in a steel tank is shown in the figure below.

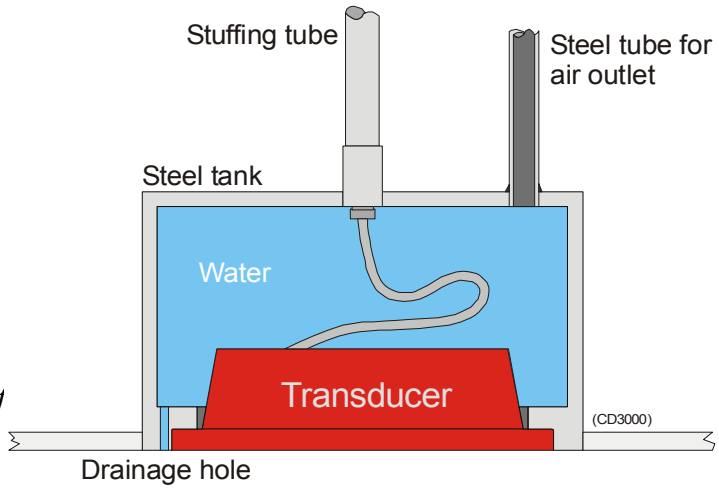


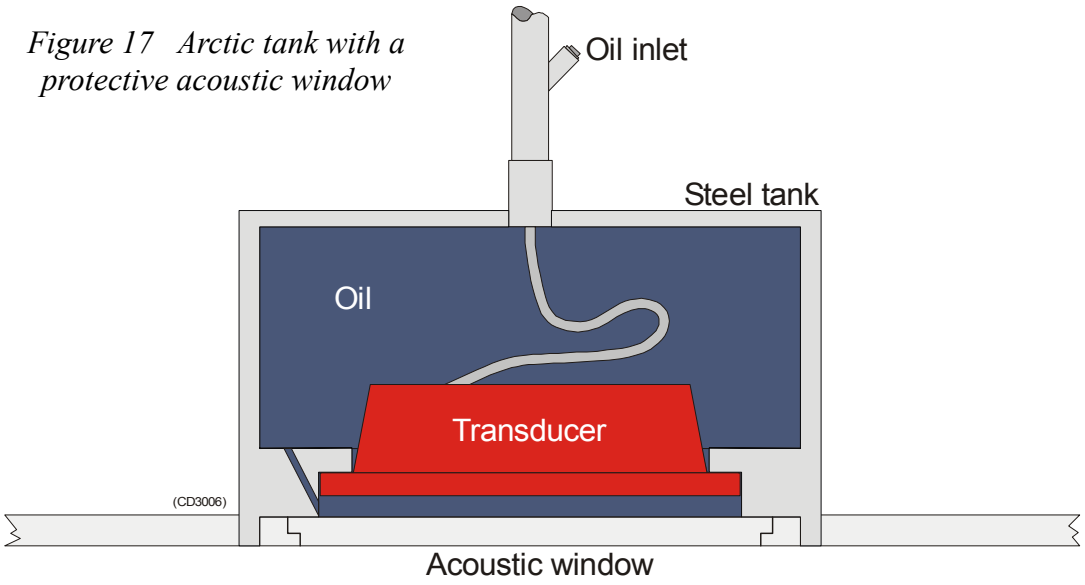

*Figure 16 Flush mounting of transducer in steel tank*

## Behind a protective acoustic window

Vessels operating in arctic waters need special attention on transducer installation. Floating blocks of ice may damage even a flush mounted transducer face. For this situation Simrad offers ‘’arctic tanks’’ in different sizes.

The transducer shown in the figure below is mounted inside the tank behind a strong acoustic window which could be made of polycarbonate. The tank is oil filled.

*Figure 17 Arctic tank with a protective acoustic window*



## Inside the hull

An installation of the transducer inside the hull, and sounding through the hull, requires a good acoustic contact between the transducer face and the hull. Build a tank around the transducer and fill it with a liquid. Oil used in hydraulic systems is a well suited liquid for this purpose. It contains no gas bubbles and is non-corrosive.

The tarnsducer can be mounted inside the hull. A substantial loss must be expected when the sound passes through the hull.

→ *Refer to figure 18.*

Typical values of the two way loss are 3 dB for polyester, 6 dB for aluminium and 10 dB for steel. Hulls made of wood or a sandwich type with foam in the middle, attenuate the sound so much that through hull sounding must be regarded as impossible. The loss varies with the distance between transducer face and the hull. The best result is obtained when the distance is half a wavelength. Consult Simrad for advice. In addition to the loss, the beam pattern is degraded, because a larger area of the hull is set into vibrations.

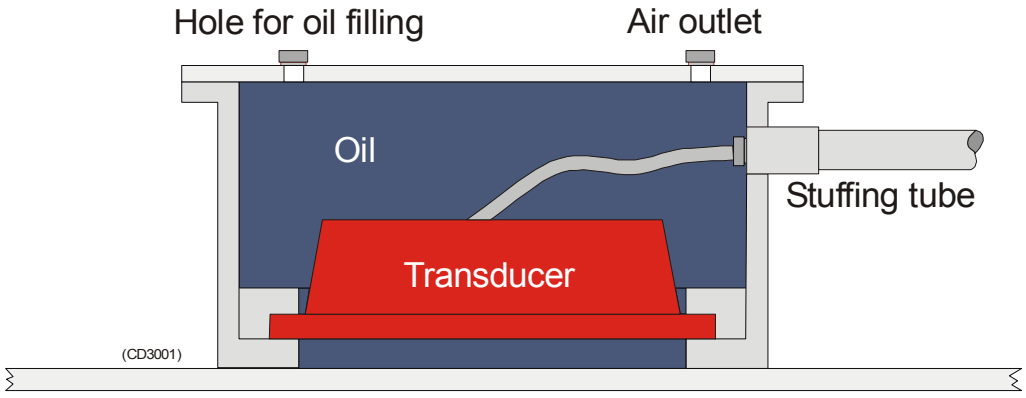



*Figure 18 Transducer mounting inside the hull*

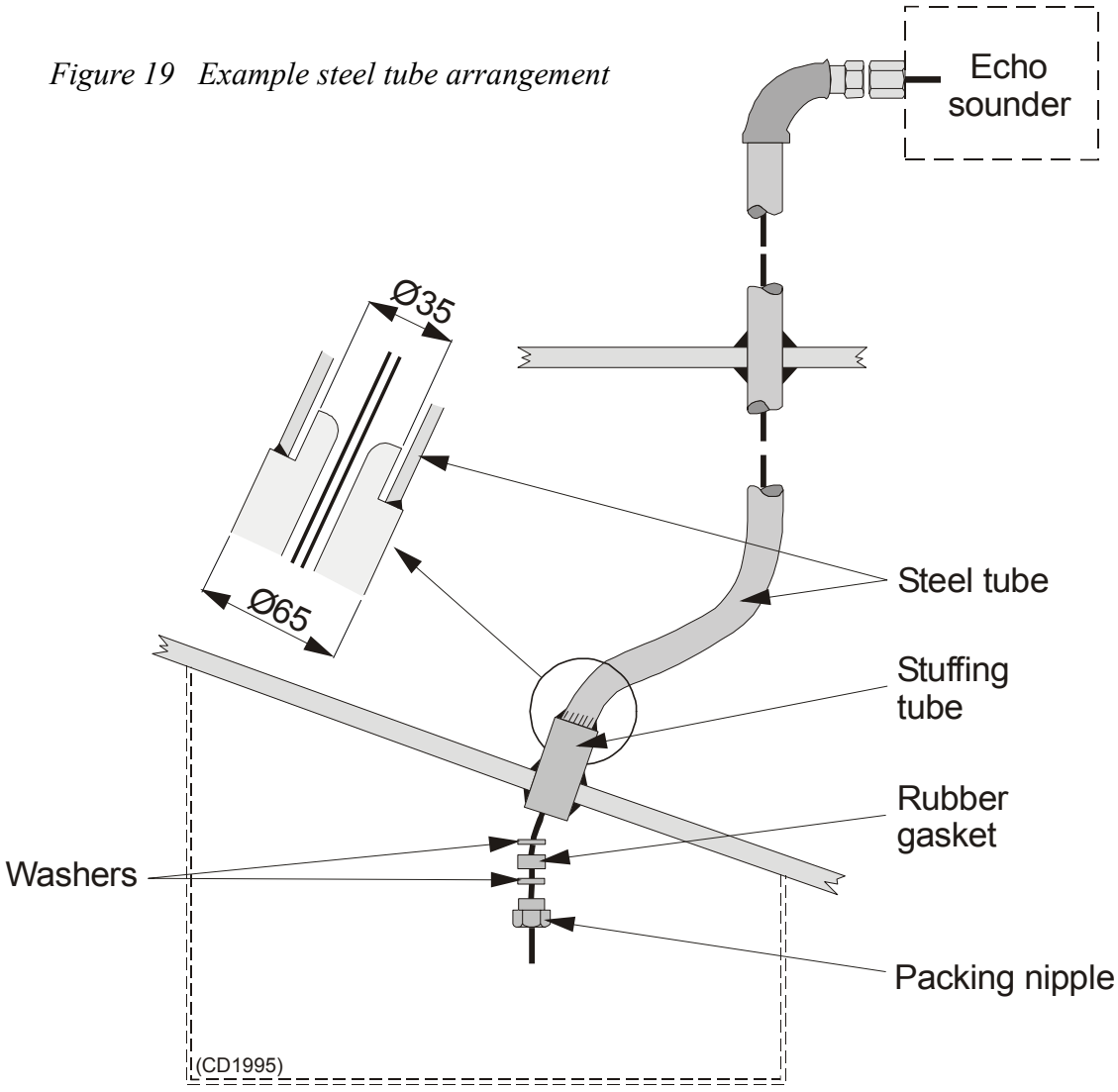
## 3.3 Cable in steel conduit

It is strongly recommended to lay a steel conduit from the transducer to the echo sounder transceiver, and draw the transducer cable through the conduit. There are two reasons for this procedure.

- First, it will make it easier at a later stage to replace the transducer.
- Second, noise and interference from other electrical equipment is greatly reduced.

With a steel conduit the installation satisfies the EU regulations for EMC interference. Without a steel conduit, there is a risk of reduced echo sounder performance.

*Figure 19 Example steel tube arrangement*



The tube should be unbroken and watertight from the transducer to above the water line. From there, openings or a junction box can be installed to facilitate drawing of the cable, or to add a cable extension. However, the tube should act as a continuous electrical screen all the way and be connected to the transceiver chassis.

Tube dimensions:

- minimum 35 mm inner diameter
- minimum 6 mm wall thickness (4.5 mm if galvanised).

If two or more transducers are installed close to each other it is possible to pull their cables in the same steel tube, provided the tube diameter is increased accordingly. However, for easy replacement it is recommended that each transducer has its own steel tube.

Most Simrad transducers are delivered with 20 m cable. Excess cable can be cut off, or an extension cable can be added. This is possible because all Simrad transducers have a built-in transformer for tuning and matching to the cable impedance of 75 Ohms.

## 3.4 Handling and maintenance

Do not lift the transducer by the cable.

Some transducers are delivered with a cover plate on the face for protection during transport. Let this plate stay on as long as possible, but do not forget to remove it before the vessel goes into the sea.

An anti-fouling paint may be applied to the transducer face. Because some paint types may be aggressive to the polyurethane in the transducer face, please consult Simrad's list of approved paints on the next page.

Note

*Arctic tanks have acoustic windows made of polycarbonate. These must neither be painted nor cleaned with chemicals.*

During dry docking of the vessel, the transducer face may be cleaned for shells and other marine fouling. Be careful not to make cuts in the transducer face. Use a piece of wood or a very fine grade emery paper.

## 3.5 Approved anti-fouling paints

This is Simrad's list of approved antifouling paints on polyurethane transducer housing.

**From Jotun Paints, Sandefjord Norway:**

- Antifouling Seamate HB 33
- Antifouling Seamate HB 66
- Antifouling Seamate HB 99
- Racing
- Non-stop

**From International Paints:**

- Intersleek tie coat + 425 FCS
  - BXA386/BXA390/BXA391 Grey
  - HKA563/HKA570/HKA571 Yellow

Mix BXA386, BXA390 and BXA391 first, then apply. When dry, mix HKA563, HKA570 and HKA571, apply.

**From Hempel IFA Coatings AS:**

- Hempel A/F Classic 76550

**From Jotun-Henry Clark Ltd:**

- Anti-fouling Seaguardian

Note

*Refer to the manufacturer's documentation and data sheets for a complete procedure.*

# 4 CABLE LAYOUT

## 4.1 Introduction

This chapter details the interconnection cables used on the EK60 system.

All cables are identified with an identification number. References are then made to the cable type, which specifies the connections to be made and the physical properties of the cable.

As several cables types are common for the various products, each type is only presented once.

### Topics

## 4.2 Cable plans and specifications

### Configurations

The system cables are identified in following cable plans. Each cable is identified with a cable number (Cx). Further information about the cable (connections and specifications) may be found on the referenced page(s).

The following main configurations are available:

- Basic configuration with standard Processing Unit
- General Purpose Transceiver (GPT)
- GPT Cabinet

Several variations may be built based on these main configurations.

#### Basic configuration

The basic configuration comprises a single General Purpose Transceiver (GPT), a Processor Unit (computer) and a display. An optional ethernet switch is added for interface purposes.

#### More than one GPT

More than one GPT may be used. An ethernet switch is then required for interface purposes.

#### GPT Cabinet

The GPT Cabinet configuration uses a steel cabinet to provide IP55 protection. One or two GPT units may be installed in the cabinet, as well as an ethernet switch if required.

## Computer and display cables

The cables shown and specified here are those used when the EK60 is implemented with a standard separate Processing Unit.

Since the computer may be supplied by a third party vendor, the interface availability will change. The most common interfaces are included in this cable layout, and those not required by the EK60 system are identified accordingly.

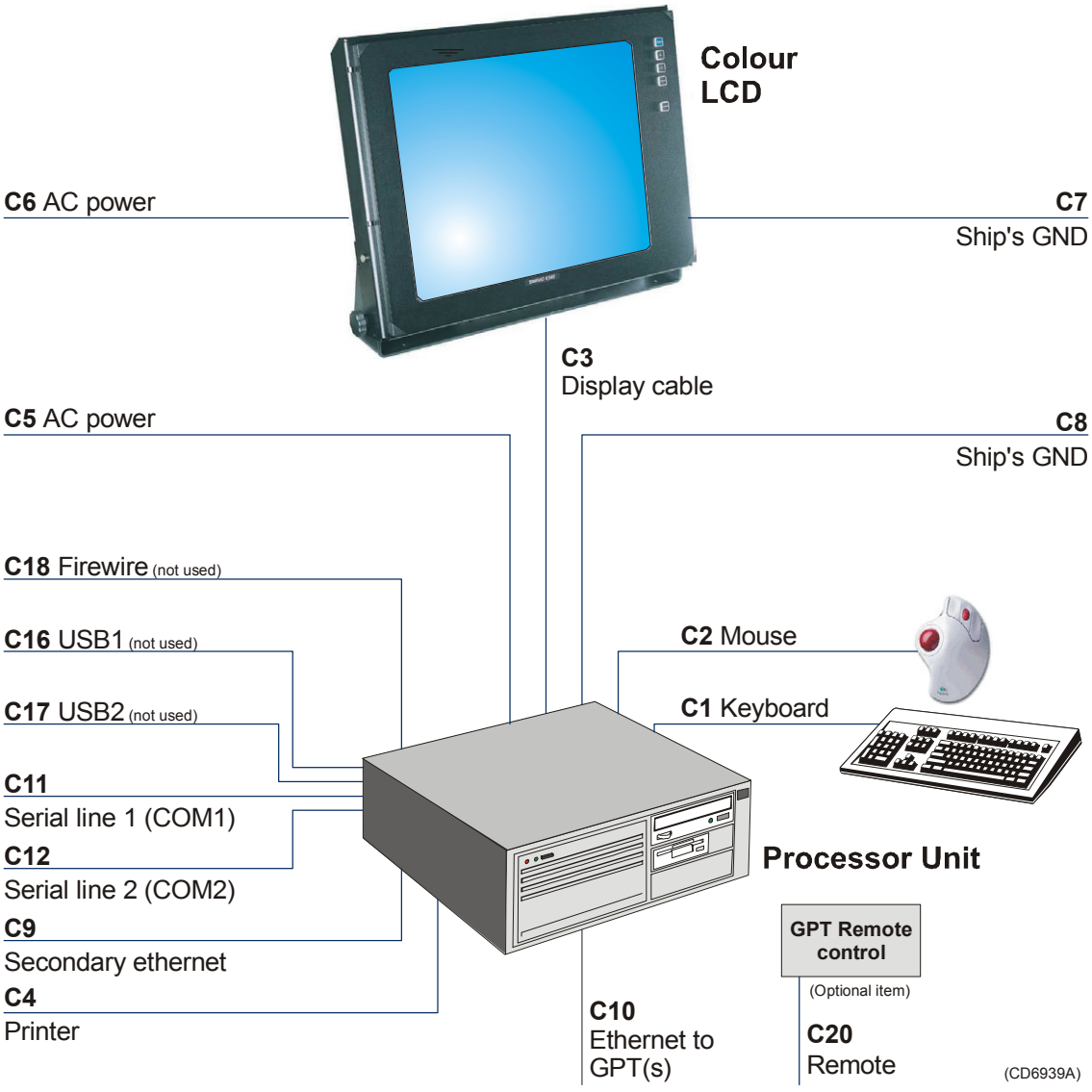



*Figure 20 Cable layout with standard Processor Unit*

### C1 - Keyboard

This is a standard computer keyboard cable. In most cases it is physically attached to the keyboard.

→ *Cable details on page 66.*

### C2 - Mouse

This is a standard computer mouse or other pointing device cable. It is physically attached to the mouse.

→ *Cable details on page 67.*

### C3 - Display

This is a standard display cable. It is often attached to the display, and terminated in the computer end with a male 15-pin Delta connector. The cable is normally supplied by the display manufacturer.

→ *Cable details on page 69.*

### C4 - Printer

The optional printer is connected to the parallel Centronics port. The cable is normally supplied by the printer manufacturer.

→ *Cable details on page 68.*

### C5 / C6 - AC Power

These are the AC power cables for the computer and the display. Before applying power, make sure to check the power rating on the units!

→ *Cable details on page 62.*

### C7 / C8 - EMC ground

Both the display and the computer must be connected to the ship's ground.

→ *Cable details on page 63.*

### C9 / C10 - Ethernet

As previously described, it is strongly recommended to equip the computer with two network adapters. One will be used to communicate with the General Purpose Transceiver/s), while the other is used to connect the EK60 system to the ship's common network.

Failure to use separate network adapters will cause a heavy traffic load on the common network. This will inhibit normal traffic on this network, and degrade the operational capabilities of the EK60 system.

With only a single GPT in use, use a "cross-over" ethernet cable between the computer and the GPT. With more than one GPT, insert an ethernet switch and use "straight" cables.

Note

*Screened ethernet (CAT5 STP) must be used.*

→ *Cable details on page 65.*

### C11 / C12 - Serial lines (RS-232)

The computer must be provided with minimum two serial lines for communication with external sensors. Additional serial lines may be added if required.

The serial lines are identified as COM1 and COM2.

→ *Cable details on page 61.*

### C13 / C14 / C15 - Future expansion

These cables are presently not in use.

### C16 / C17 - USB interfaces

Most current computers have one or more USB interfaces. These are not required by the EK60 system.

### C18 - FireWire interface

Most current computers have a FireWire interface. This is not required by the EK60 system.

### C20 - Remote

This is the remote power control cable from the GPT. It is often terminated in a small on/off switch box close to the computer and display. This box is not supplied by Simrad.

## Single GPT cables

The cables shown and specified here are those used when the EK60 is implemented with a stand-alone General Purpose Transceiver (GPT) unit.

Note that the **Auxiliary** plug on the GPT provides several interfaces that are not used with the EK60.

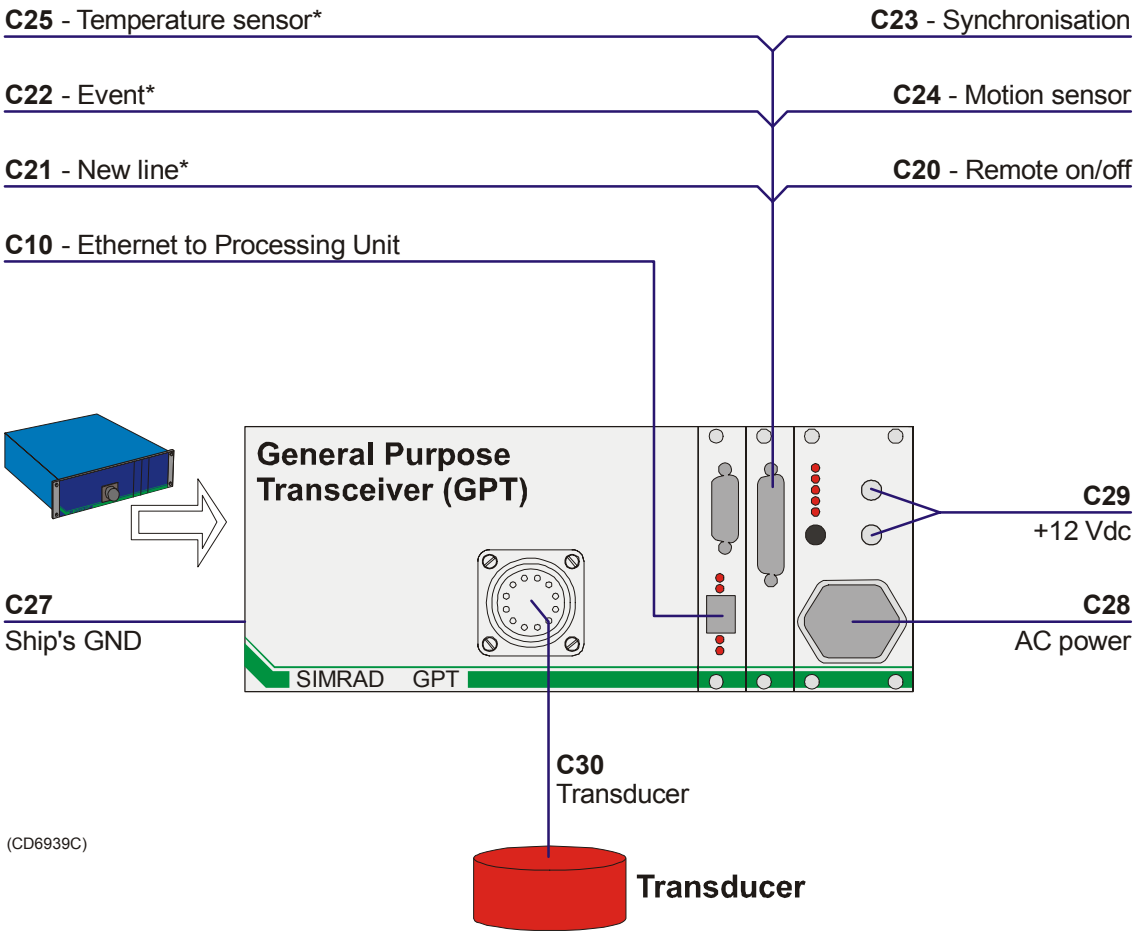



*Figure 21 EK60 cable plan - Single GPT*

Connections identified with an asterix (*) in the drawing have not been implemented in the EK60 software.

### C10 - Ethernet

This is the dedicated ethernet cable which connects the GPT with the Processing Unit computer. With only a single GPT in use, use a “cross-over” ethernet cable between the units.

Note *Screened ethernet (CAT5 STP) must be used.*

→ *Cable details on page 65.*

### C20 - Remote

This is the remote power control cable from the GPT. It is often terminated in a small on/off switch box close to the computer and display. This box is not supplied by Simrad.

→ *Cable details on page 72.*

### C21 - New line

This is an input to provide manual count of survey lines. This functionality is however not currently supported by the EK60 software.

### C22 - Event

This is an input to provide a manual vertical line annotation on the echogram. This functionality is however not currently supported by the EK60 software.

### C23 - Synchronization

With more than one acoustic system installed on the same vessel, it is often useful to have a means of syncronizing the transmissions to avoid interference and other disturbance. One way of synchronizing the EK60 system is by using these pins on the **Auxiliary** plug.

→ *Cable details on page 73.*

### C24 - Motion sensor

Use this input for an analogue motion sensor.

→ *Cable details on page 74.*

### C25 - Temperature sensor

This is an input to provide water temperature from an external sensor. This functionality is however not currently supported by the EK60 software.

→ *Cable details on page 74.*

### C26 - Future expansion

This cable is presently not in use. It is not shown on the cable layout drawing.

### C27 - EMC ground

The General Purpose Transceiver (GPT) must be connected to the ship’s ground.

→ *Cable details on page 63.*

### C28 - AC Power

This is the AC power cable for the GPT.

→ *Cable details on page 62.*

### C29 - +12 Vdc

The +12 Vdc input/output connectors can be used in the following ways:

- Operate the transceiver from a +12 Vdc power supply.
- Operate the transceiver from mains power, but leave a battery connected to the DC connectors. The battery will then provide you with an uninterruptable power supply facility. It will automatically be charged when the mains power is present.
- Use the +12 Vdc power from the transceiver to power external units.

→ *Cable details on page 64.*

### C30 - Transducer

The transducer cable is fixed to the transducer. The standard transducer cable supplied is 20 meters long.

Note

*The transducer cable between the transducer GPT must be run in steel conduits. Use flexible conduit close to the plug on the transceiver.*

→ *Cable details on page 76.*

### GPT Connectors

The following connectors are located on the rear side of the General Purpose Transceiver (GPT) unit.

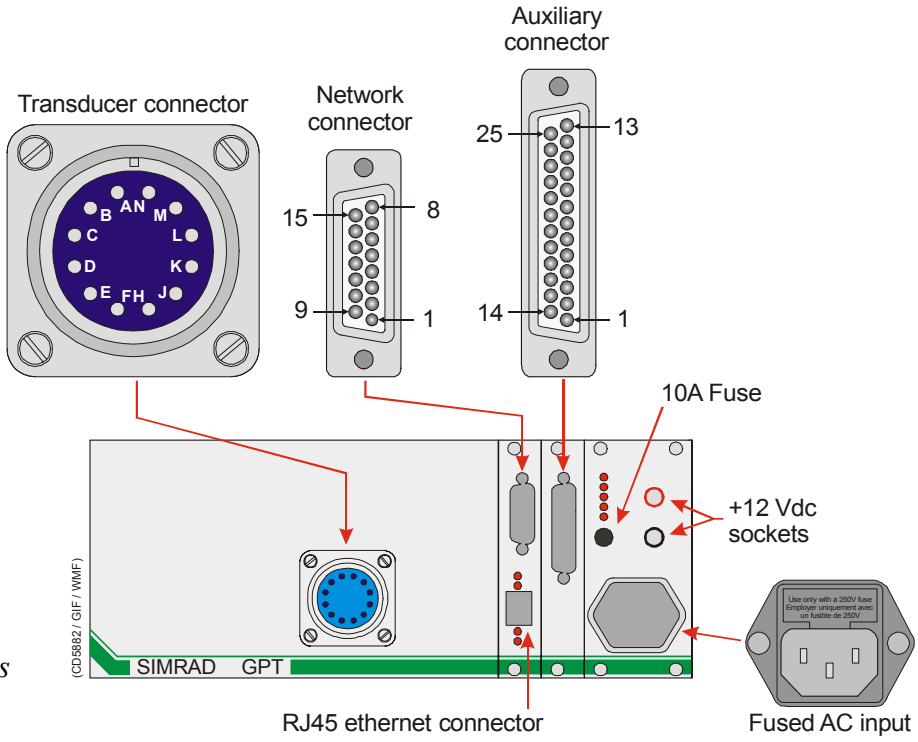



*Figure 22*
*GPT connectors*

## Multiple GPT cables

The cables shown and specified here are those used when the EK60 is implemented with more than one General Purpose Transceiver (GPT) unit.

Note that the **Auxiliary** plug on the GPT provides several interfaces that are not currently used with the EK60.

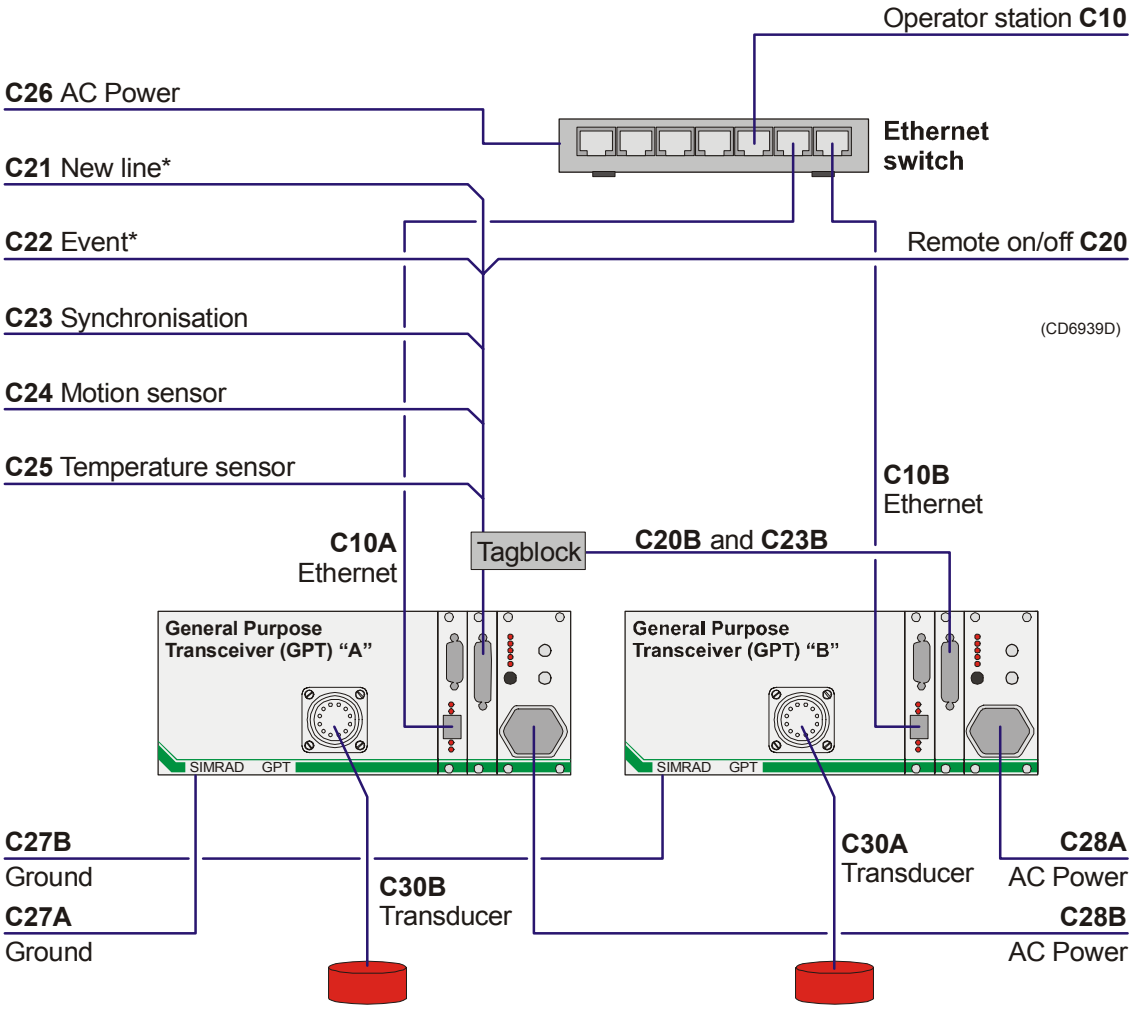



*Figure 23 EK60 cable plan - Multiple GPTs*

### External connections

Note that the external peripherals are connected to either one of the transceivers or to all of them in parallel.

**Event**, **Survey line** and the two sensors are only connected to one GPT, while **Synchronization** and **Remote on/off** are connected to all in parallel. It is strongly recommended to use a tagblock to ease the cabling.

Connections identified with an asterix (*) in the drawing have not been implemented in the EK60 software.

### C10 - Ethernet

This is the dedicated ethernet cable which connects the transceivers with the Processing Unit computer. With more than one GPT in use, you must use an ethernet switch and “straight” cables.

- One “straight” ethernet cable from the Processor Unit and to the Ethernet Switch
- One “straight” ethernet cable from the Ethernet Switch to each of the transceivers.

Note

*Screened ethernet (CAT5 STP) must be used.*

→ *Cable details on page 65.*

### C20 - Remote

This is the remote power control cable from the GPT. The cable must be connected in parallel to each of the transceivers.

→ *Cable details on page 72.*

### C21 - New line

This is an input to provide manual count of survey lines. This functionality is however not currently supported by the EK60 software.

### C22 - Event

This is an input to provide a manual vertical line annotation on the echogram. This functionality is however not currently supported by the EK60 software.

### C23 - Synchronization

The synchronization input must be connected in parallel to each of the transceivers.

→ *Cable details on page 73.*

### C24 - Motion sensor

Use this input for an analogue motion sensor. It is only necessary to connect this input to one of the transceivers.

→ *Cable details on page 74.*

### C25 - Temperature sensor

This is an input to provide water temperature from an external sensor. This functionality is however not currently supported by the EK60 software.

→ *Cable details on page 74.*

### C26 - AC Power to Ethernet Switch

Several types of switches are available. Some have internal power supplies, other rely on small external power supplies.

→ *Cable details on page 62.*

### C27 - EMC ground

Each of the General Purpose Transceivers (GPT) must be connected to the ship's ground.

→ *Cable details on page 63.*

### C28 - AC Power

These are the AC power cables for the GPTs.

→ *Cable details on page 62.*

### C29 - +12 Vdc

The optional +12 Vdc input/output connector, one for each GPT. For simplicity, these have been omitted from the cable drawing.

→ *Cable details on page 64.*

### C30 - Transducer

The transducer cable is fixed to the transducer. The standard transducer cable supplied is 20 meters long.

Note

*The transducer cable between the transducer GPT must be run in steel conduits. Use flexible conduit close to the plug on the transceiver.*

→ *Cable details on page 76.*

## GPT Cabinet

The cables shown and specified here are those used when the EK60 is implemented with a GPT Cabinet for IP55 protection. The cabinet may contain one or two General Purpose Transceiver (GPT) units and an ethernet switch. All internal cabling in the cabinet is made by the manufacturer.

Note that all cables connect to the main tagblock with the exception of the ethernet cable(s) and the transducer cables(s).

### C10 - Ethernet

If only one General Purpose Transceiver (GPT) is mounted in the GPT Cabinet, the ethernet switch may not be fitted. If a single ethernet cable is used between the operating station and the GPT unit, this must be twisted (”cross-over” connection). If an ethernet switch is installed, straight cables are used. With two GPT units in use, the switch is always present.

Note

*Screened ethernet (CAT5 STP) must be used.*

→ *Cable details on page 65.*

### C20 - Remote

This is the remote power control cable from the on/off switch. The two wires are connected between digital ground and position 19 on the tagblock.

→ *Cable details on page 70.*

### C21 - New line

This is an input to provide manual count of survey lines. This functionality is however not currently supported by the EK60 software.

### C22 - Event

This is an input to provide a manual vertical line annotation on the echogram. This functionality is however not currently supported by the EK60 software.

### C23A / C23B - Synchronization

There are two synchronization inputs, one to each of the transceivers.

→ *Cable details on page 70.*

### C24 - Motion sensor

Use this input for an analogue motion sensor. It is only necessary to connect this input to one of the transceivers.

→ *Cable details on page 70.*

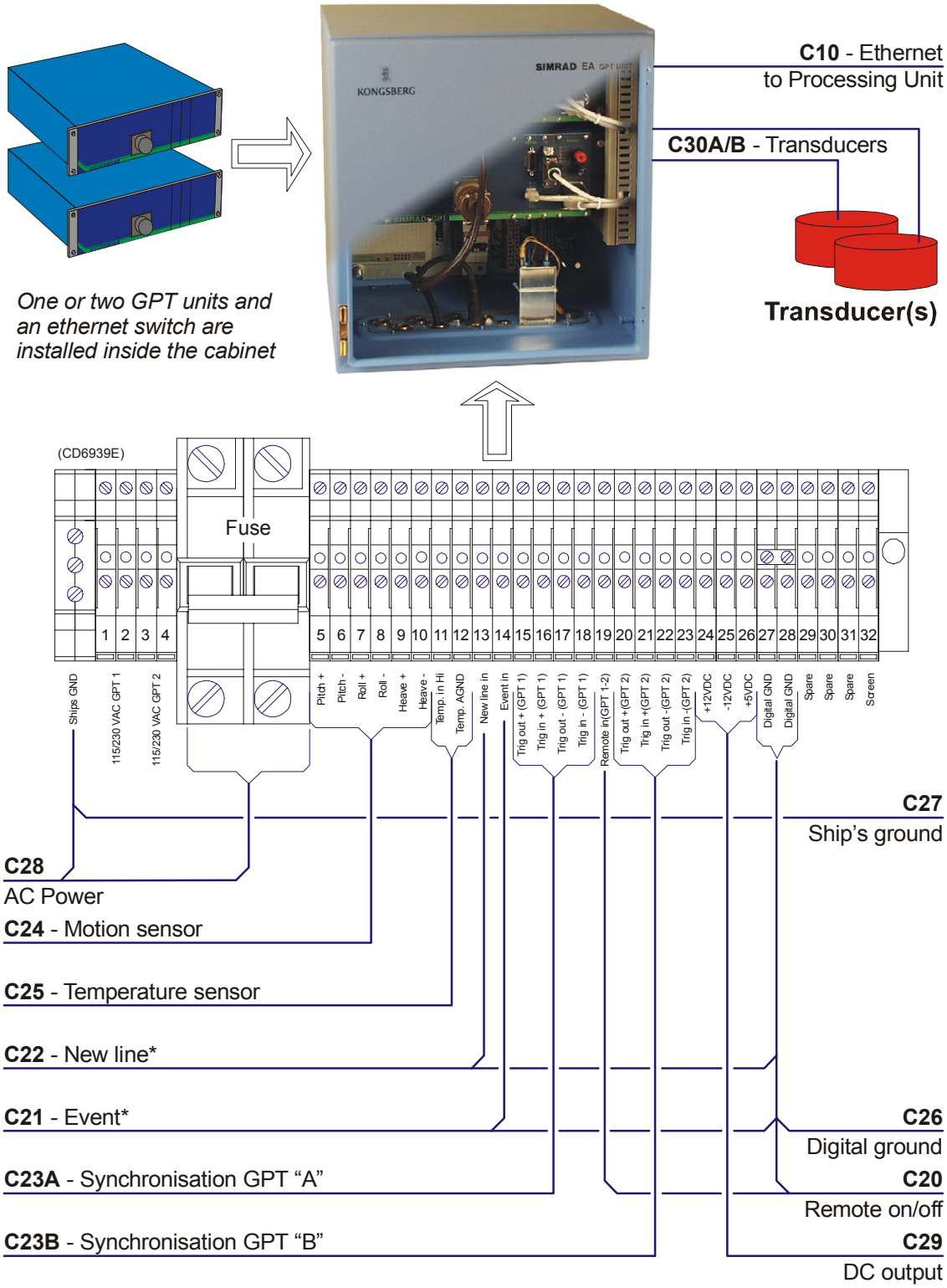



*Figure 24 EK60 cable plan - GPT Cabinet*

### C25 - Temperature sensor

This is an input to provide water temperature from an external sensor. This functionality is however not currently supported by the EK60 software.

### C26 - Digital ground

Use this for signal grounding.

→ *Cable details on page 70.*

### C27 - Ship's ground

Use this for EMC grounding.

→ *Cable details on page 70.*

### C28 - AC Power

This is the AC power connection for the entire cabinet.

→ *Cable details on page 70.*

### C29 - DC output

DC outputs are available from the internal power supply.

→ *Cable details on page 70.*

### C30A / C30B - Transducers

The transducer cable is fixed to the transducer. The standard transducer cable supplied is 20 meters long.

Note

*The transducer cable between the transducer and the GPT Cabinet must be run in steel conduits. Use flexible conduit close to the plug on the transceiver.*

→ *Cable details on page 76.*

### Using more than one GPT Cabinet

If more than one GPT Cabinet is used remember the following:

- Seperate synchronisation to each cabinet.
- Remote is normally connected in parallell, but that is eligible.
- The motion sensor is connected to one GPT Cabinet only.
- The temperature sensor is connected to one GPT Cabinet only.
- The "New line in" is connected to one GPT Cabinet only.
- The "Event in" is connected to one GPT Cabinet only.

## 4.3 External interfaces

### Overview

The computer provides one or more multi purpose RS-232 ports (9-pin male D-connector) for external interfacing at its rear. On the Simrad EK60, these are used for:

- NMEA navigation receiver input
- Depth telegram output
- ITI (Integrated Trawl Instrumentation) communication
- Purse seine
- Motion sensor input
- Synchronization

An analogue heave, roll and pitch sensor may be connected directly to the **Auxiliary** connector of the nearest transceiver.

A colour printer may be connected to the printer port (25-pin female D-connector) at the rear of the computer.

### NMEA instruments

GPS (Global Positioning System) receivers output NMEA 0183 telegrams containing geographical latitude and longitude. The defined communication parameters are:

- 4800 bits per second
- 8 data bits
- no parity
- one stop bit

However, most navigation receivers allow different parameters to be entered.

Connect the navigation receiver to a free RS232 port. Only the signal (Rx, pin 2) and ground wires (pin 5) need to be connected.

Connect only the signal wire (Tx, pin 3) and the ground wire (pin 5) to the sensor's output.

Maximum cable length is approximately 10 meters.

### Trawl system

Communication with the Simrad ITI (Integrated Trawl Instrumentation) is based on NMEA telegrams.

Connect the ITI to a free RS232 port. Only the receive signal wire (Rx, pin 2), the transmit signal wire (Tx, pin 3) and the ground wire (pin 5) need to be connected.

Maximum cable length is approximately 10 meters.

## Heave sensor

A heave sensor with an analogue output is connected directly to the **Auxiliary** connector.

The positive heave input signal (pin 3) is connected to the sensor output terminal. The negative heave input signal (pin 16) is grounded at the sensor in order to prevent ground potential offsets between the sensor and the transceiver from adding to the sensed signal.

Maximum cable length is virtually unlimited.

Motion sensors with a serial line output may also be connected to a free RS-232 port at the rear of the computer. Maximum cable length is approximately 10 meters.

Motion sensor with an ethernet output are connected to the ship's network, and will be accessed by the EK60 when set up to do so.

## Purse seine

Communication with the Simrad PI30 (Purse Seine system) is based on NMEA telegrams.

Connect the PI30 to a free RS232 port at the rear of the computer. Only the receive signal wire (Rx, pin 2), the transmit signal wire (Tx, pin 3) and the ground wire (pin 5) need to be connected.

Maximum cable length is approximately 10 meters.

## Colour printer

Connect the printer to the parallel port, use a standard printer cable with all wires connected. Maximum cable length for parallel cable is approximately 10 meters.

## 4.4 External triggering

### Overview

Whenever more than one hydroacoustic system (echo sounder or sonar) is installed on a vessel, interference may occur. To avoid this, the systems may either be connected to a common synchronization system, or one of the acoustic systems may be defined as a “master”.

The EK60 echo sounder include interface for remote transmit synchronisation. The system can be set up to operate in either **Master** or **Slave** mode in relation to an external synchronization or hydroacoustic system.

Extyernal synchronization may be connected to a serial port on the Processing Unit or to the **Auxiliary** plug on the General Purpose Transceiver (GPT).

### Master system using the Auxiliary plug

When the EK60 system is set up to operate as a Master in a system, the **TrigOut** signal from the GPT **Auxiliary** connector must be connected to the external trigger input on the other hydroacoustic system(s). Two **TrigOut** signals are available for either positive or negative triggering.

Note

*Simultaneous transmission of more than one system can only take place if the systems operate with different frequencies!*

The **TrigOut+** signal is an open collector output (max 100 mA) containing a 100-kohm pullup resistor to +5 Vdc. This signal is normally low. The **TrigOut+** signal goes high when the transceiver is ready to transmit, and it goes low again when all frequency channels of the transceiver have finished transmitting.

**TrigOut-** is the inverse of **TrigOut+**.

Connect the ground wire to one of the **Ground** pins (18-22).

### Slave system using the Auxiliary plug

If an external system is used to provide the transmit trigger, the trigger signal must be connected to one of the **TrigIn** inputs on the GPT **Auxiliary** connector. When activated. the trigger signal from the external system will allow the EK60 system to transmit.

Two **TrigIn** inputs are available for either positive or negative triggering. The **TrigIn-** input is sensitive to a high-to-low transition.

Connect the ground wire to one of the **Ground** pins (18-22).

Note

*If the EK60 system comprises more than one GPT unit, the external trigger must be connected in parallel to every GPT.*

## Synchronization using a serial port

When the EK60 system shall be synchronized using a serial port, a standard connection is used, but with only the CTS and RTS signal applied.

Setting up the EK60 as master or slave is made in the ER60 **Ping Control** dialogue.

## 4.5 Cable terminations and details

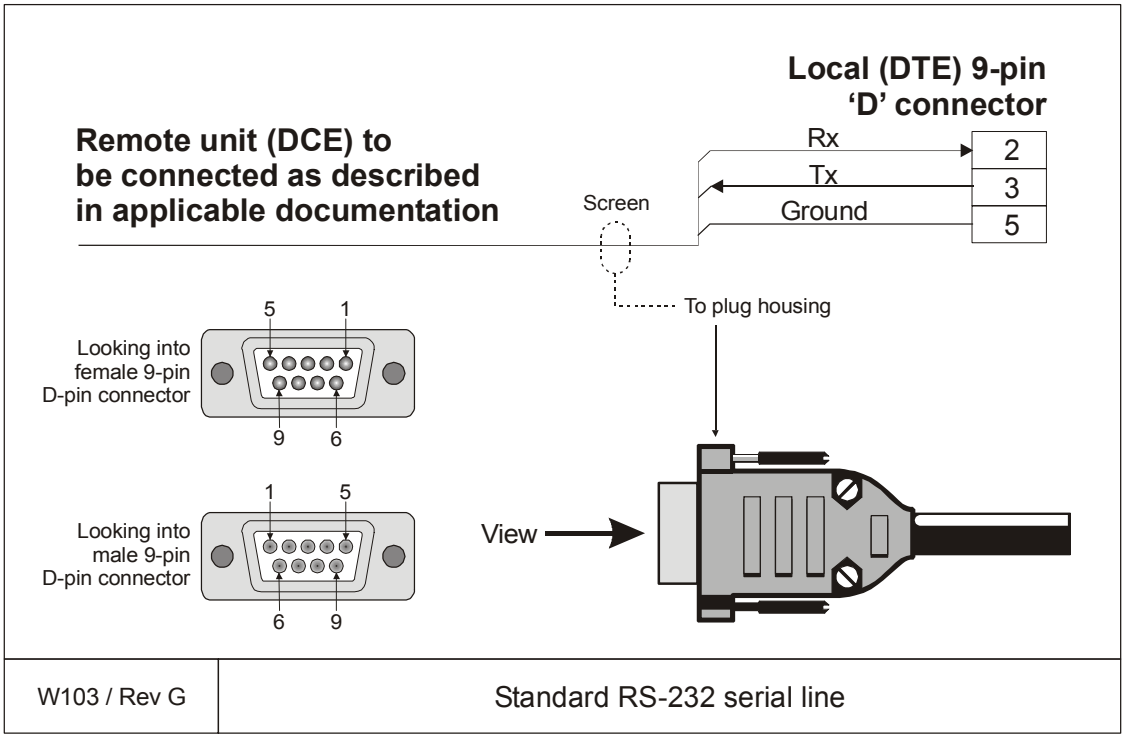
Refer to the referenced specific cable drawings on the referenced pages for more detailed information about each cable.

### Topics

## Generic RS-232 Serial line

This cable comprises a multi-purpose serial line. It provides interface with any peripheral unit. One end of the cable connects to the local unit (DTE) with a 9-pin ’D’ connector, while the other connects to the peripheral (DCE) as described in the peripheral unit’s documentation.

Note that this cable does not support all the signals in the standard RS-232 specification.

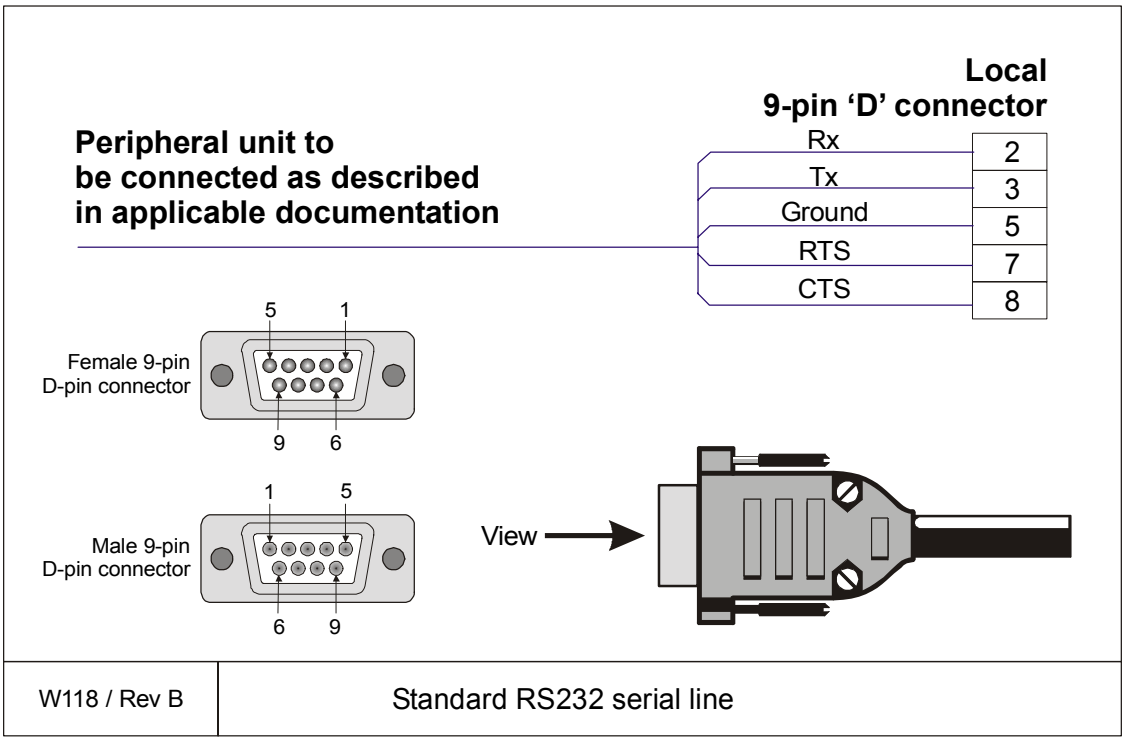



| W103 / Rev G | Standard RS-232 serial line |
|---|---|

| | |
|---|---|
| Conductors | 3 x 2 x 0.5 mm2 |
| Screen | Overall braided |
| Voltage | 60V |
| Max.diameter | Set by the plugs |

## Generic RS-232 with CTS and RTS

This is a standard serial cable terminated into a 9-pin D-connector.

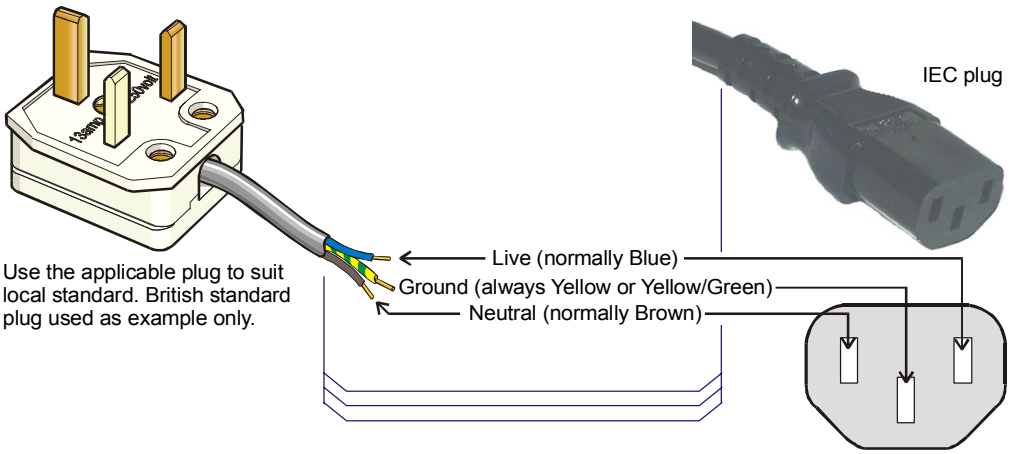



| W118 / Rev B | Standard RS232 serial line |
|---|---|

| | |
|---|---|
| Conductors | 6 x 0.5 mm2 |
| Screen | Overall braided |
| Voltage | 60 V |
| Max.diameter | Limited by the plugs |

## Standard AC power cable

This cable is a standard three-wire power cable. It is commercially available in standard lengths, or may be produced locally to suit the specific installation needs. The instrument end is terminated in a standard IEC female socket, while the other end is terminated in a plug suitable for the local standard.




| W301 / Rev B | Standard power cable for 115/230 Vac 2-phase |
|---|---|

Note

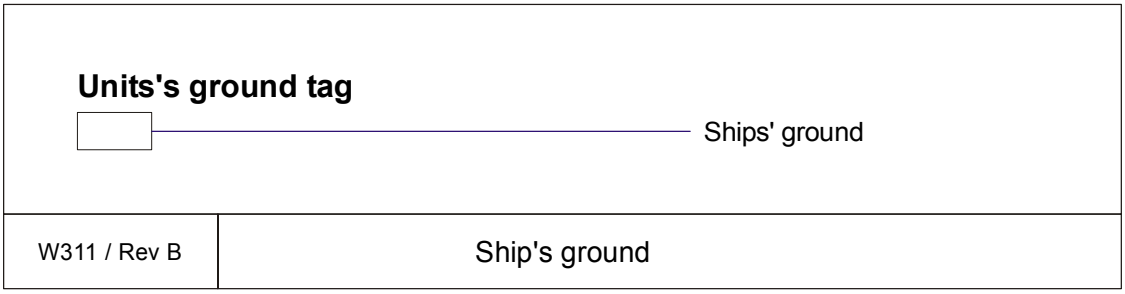
*Different cable colours may be used for the "live" and "neutral" wires. Ground is however always on green/yellow.*

| | |
|---|---|
| Conductors | 2 x 1.5 $mm^2$ + GND |
| Screen | None |
| Voltage | 750 V |
| Max. diameter | Set by the plugs |

## EMC ground

This cable is used to connect the system unit to the ship’s ground.

Note that this cable must be as short as possible.

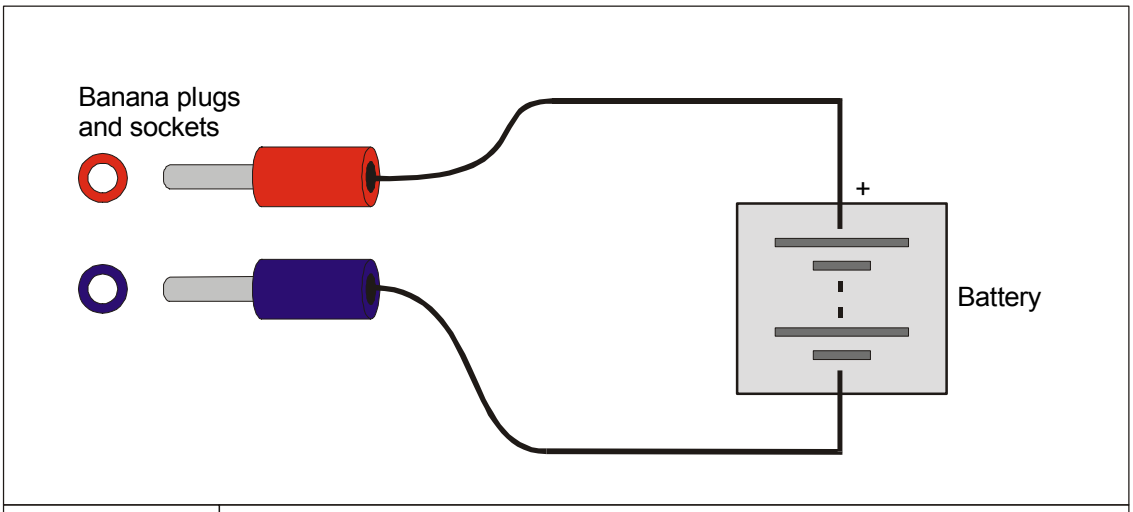



| | |
|---|---|
| W311 / Rev B | Ship's ground |

| | |
|---|---|
| Conductors | 1 x 6 mm2 |
| Screen | None |
| Voltage | 60 V |
| Max.diameter | N/A |

## Battery

This cable is used to connect a battery to the system.

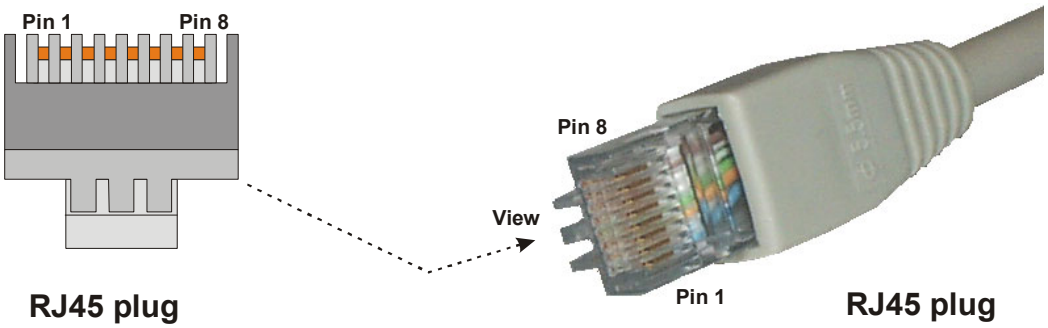


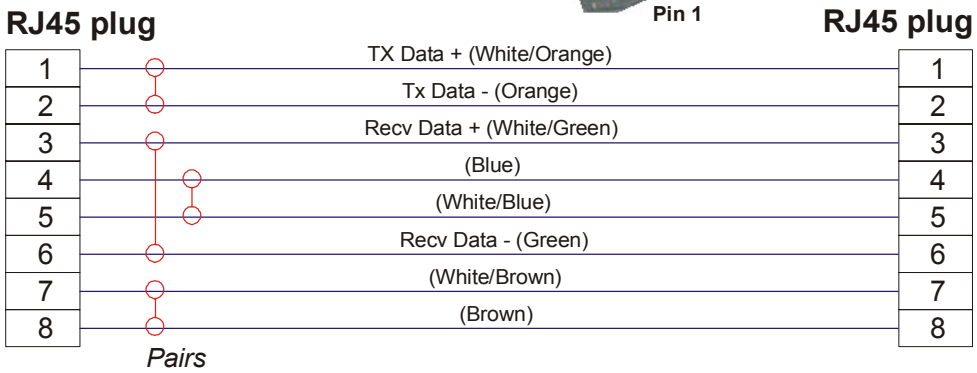

| | |
|---|---|
| W319 / Rev. A | Battery |

| | |
|---|---|
| Conductors | 2 x 1.5 mm2 |
| Screen | None |
| Voltage | Selected to fit the battery voltage |
| Max.diameter | N/A |

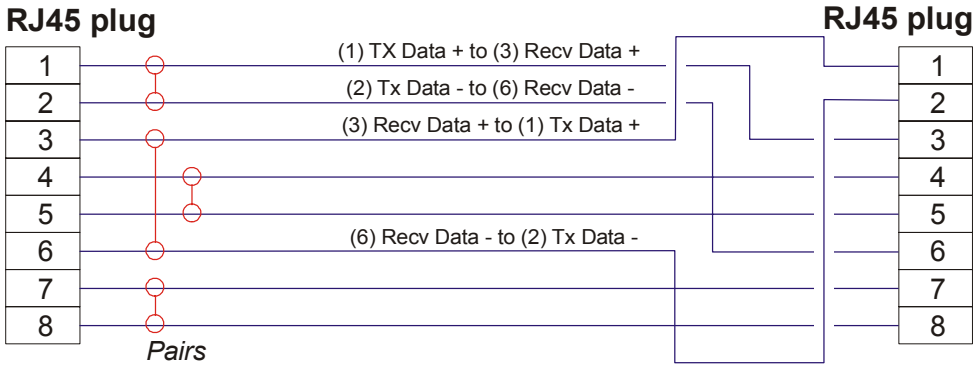
## Ethernet with RJ45

This cable contains the Ethernet connection. RJ45 plugs are used to terminate the cable. Note that these plugs must be screened to comply to EC rules.




***Ethernet 10Base-T "Straight Through"***




***Ethernet 10Base-T "Crossover"***

**NOTE:** In order to prevent noise and crossover, you are strongly adviced to use the cable pairs indicated above.

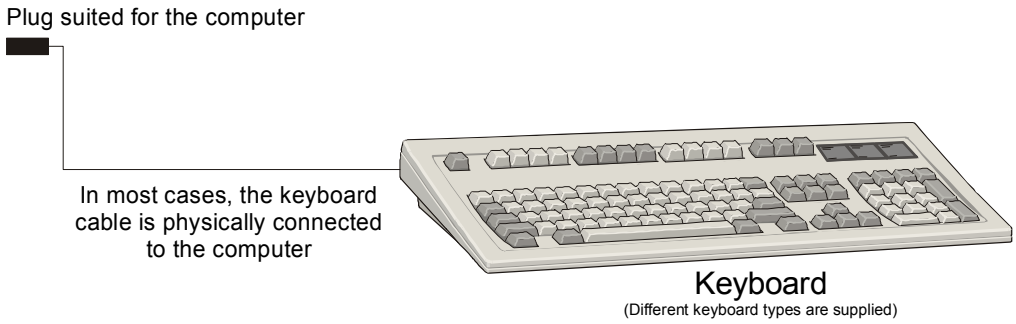
The "crossover" cable is used to cascade HUBs, or for connecting two ethernet stations or computers back-to-back without a HUB)

| | |
|---|---|
| W400 / Rev E | Ethernet 10Base-T with RJ45 plugs |

## Keyboard cable

This is a standard keyboard cable. In most cases, the cable is physically connected to the keyboard. It is terminated in a plug suited to fit the computer.

Several keyboard types are available for different languages and hardware platforms. Both the keyboard and the attached cable are commercial items.




| | |
|---|---|
| W503 / Rev C | Keyboard |

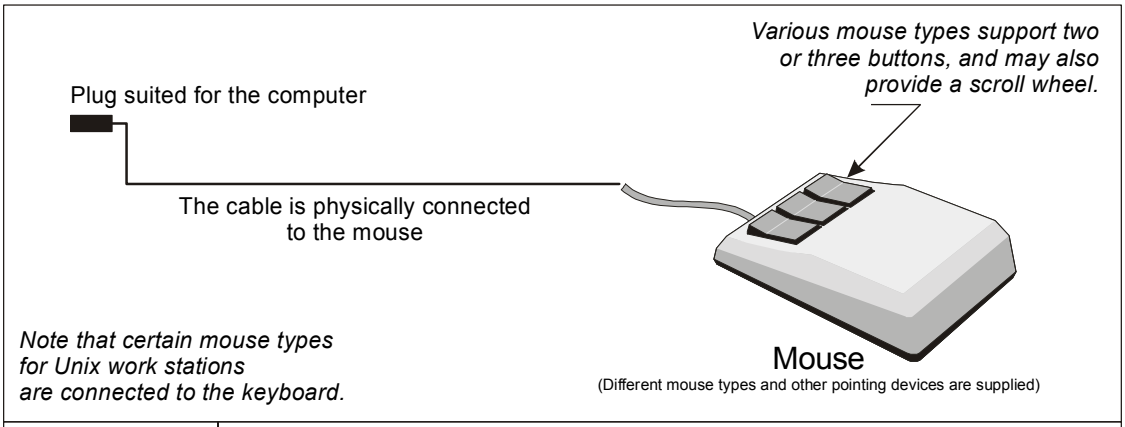
## Mouse or pointing device cable

This is a standard mouse cable. It is physically connected to the mouse. It is terminated in a plug suited to fit the computer.

Note

*On Unix work stations, the mouse is normally connected to the keyboard.*

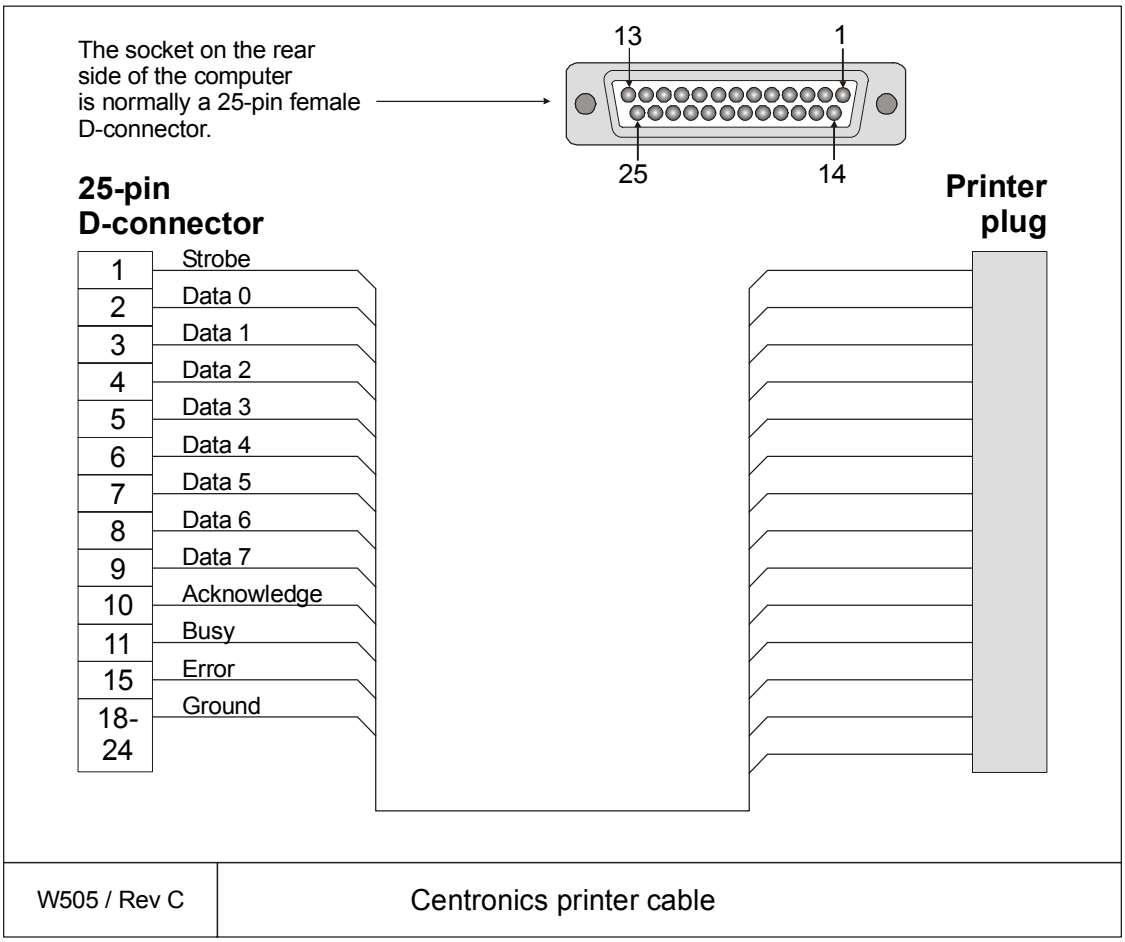
Several mouse and pointing device types are available with two or three buttons, and with or without a scroll wheel. Both the mouse and the attached cable are commercial items.




| W504 / Rev B | Mouse / Pointing device |
|---|---|

## Centronics printer cable

This is a standard Centronics printer cable.

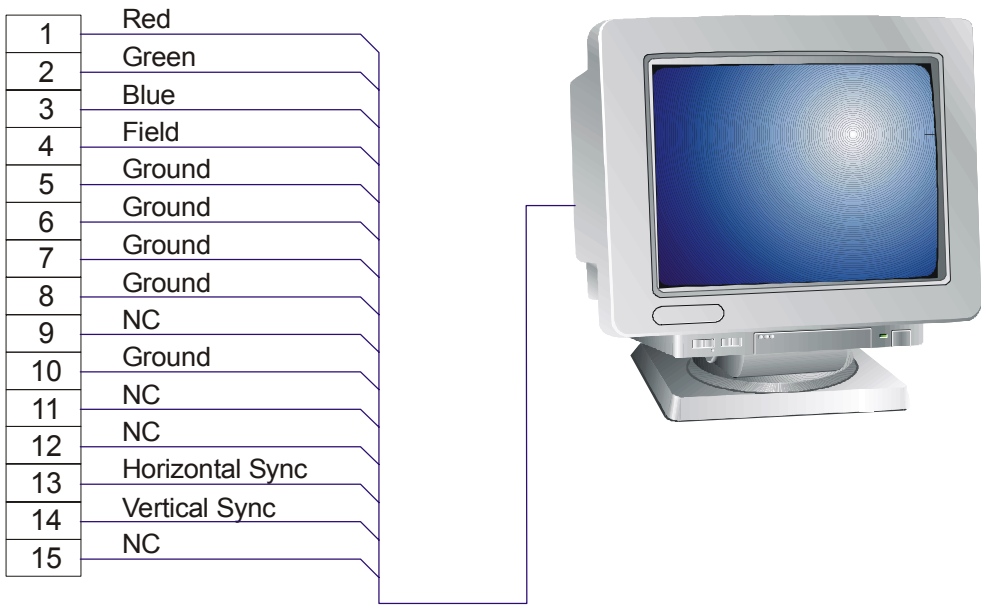



| W505 / Rev C | Centronics printer cable |
|---|---|

## VGA display cable

This is a standard VGA display cable.

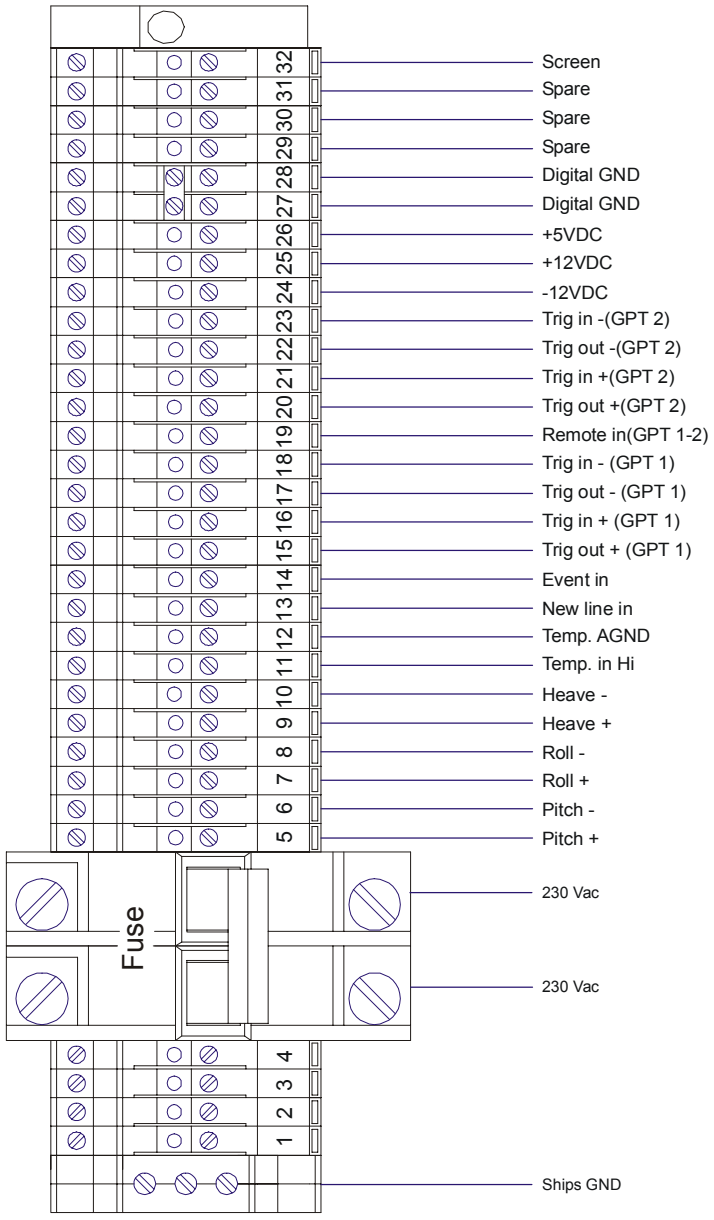
It is terminated in a standard commercial VGA plug. In most cases, the cable is physically attached to the rear side of the display.




| | |
|---|---|
| W506 / Rev.B | Display Unit (VGA) |

## GPT Cabinet interface cables

These are the cables used to interface the GPT Cabinet. Note that ethernet and transducer cables are described separately.




For internal cabinet wiring, refer to 824-214954 (CD5980A)

| W619 / Rev.A | GPT Cabinet cables |
|---|---|

Specifications for each of the cables (except AC power cables):

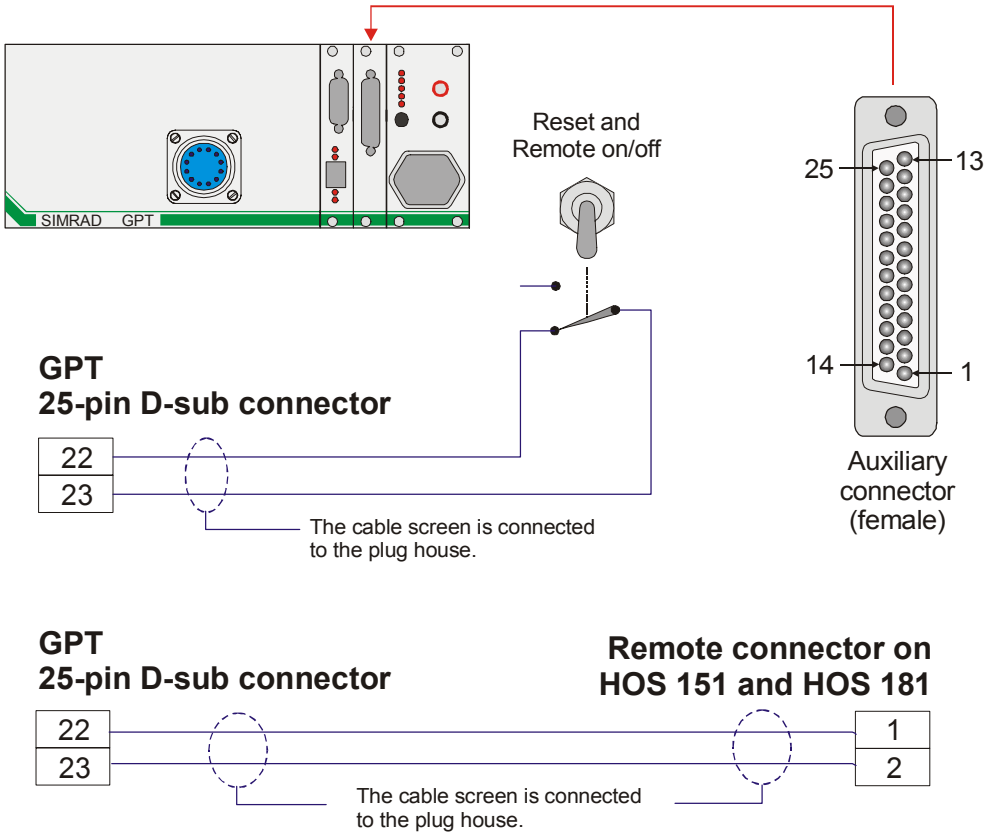
| | |
|---|---|
| Conductors | N x 0.5 mm2 |
| Screen | Overall braided |
| Voltage | 60 V |
| Max.diameter | Set by the plugs |

Specifications for AC power cable:

| | |
|---|---|
| Conductors | 3 x 2.5 mm2 |
| Screen | Separate conductor |
| Voltage | 750 V |
| Max.diameter | Set by the plugs |

## Remote on/off

This cable is used to connect a remote on/off switch to the General Purpose Transceiver (GPT). The switch can be located in a separate box, or incorporated on a common switch panel.

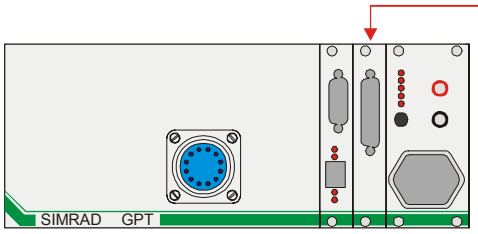


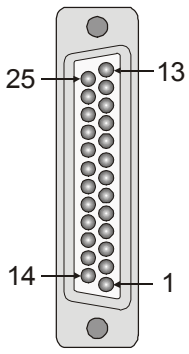

| | |
|---|---|
| W620a / Rev C | Remote on/off |

| | |
|---|---|
| Conductors | 2 x 0.22 mm2 |
| Screen | Overall braided |
| Voltage | 60 V |
| Max.diameter | Set by the plugs |

## GPT Remote synchronisation

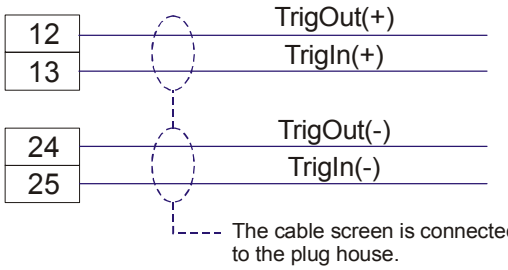
This cable is used to connect the General Purpose Transceiver (GPT) to an external system for synchronisation purposes.




Auxiliary connector (female)

**GPT**
**25-pin D-sub connector**



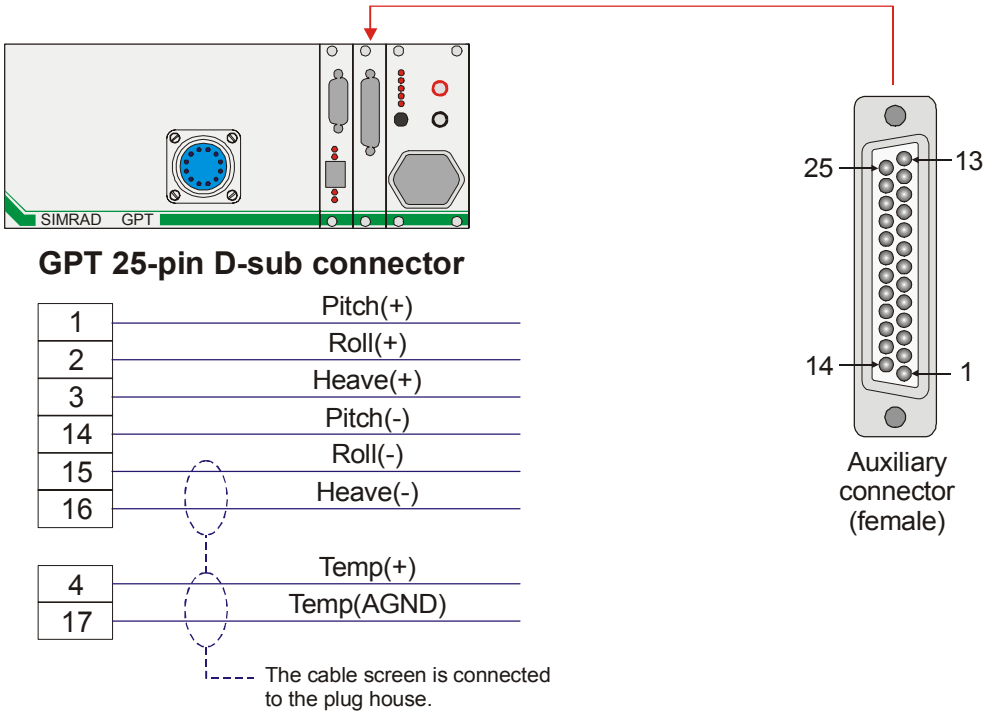

Several transceivers may be triggered from an external system by connecting the TrigIn pins in parallel.

| | |
|---|---|
| W620b / Rev C | External trigger in/out |

| | |
|---|---|
| Conductors | 2 x 2 x 0.22 mm2 |
| Screen | Braided pairs and overall braided |
| Voltage | 60 V |
| Max.diameter | Set by the plugs |

## Heave and Temperature sensors

This cable is used to connect the General Purpose Transceiver (GPT) to external Heave and Temperature sensors.

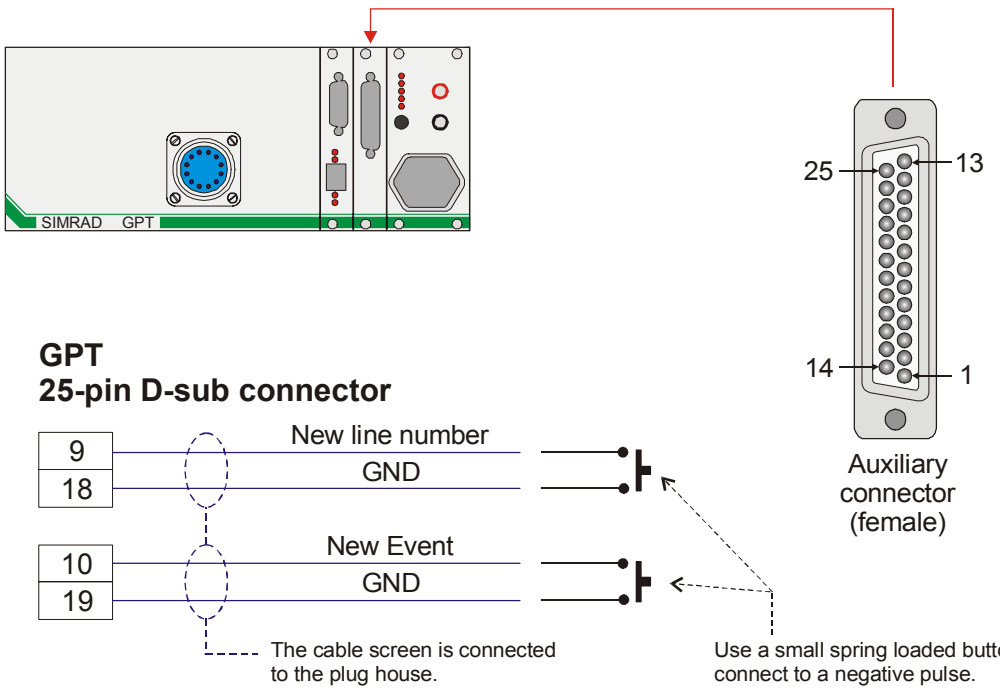



| | |
|---|---|
| W620c / Rev C | Heave, Roll, Pitch and Temperature sensors |

| | |
|---|---|
| Conductors | 2 x 0.22 mm2 |
| Screen | Overall braided |
| Voltage | 60 V |
| Max.diameter | Set by the plugs |

## New Event and Line number

This cable is used to connect the General Purpose Transceiver (GPT) to two external buttons for generation of new “Events” and “Line numbers”.




| | |
|---|---|
| W620d / Rev C | “Event” and “New line number” buttons |

| | |
|---|---|
| Conductors | 2 x 0.22 mm2 (for each button) |
| Screen | Overall braided |
| Voltage | 60 V |
| Max.diameter | Set by the plugs |

## Transducer(s)

The cables described in this chapter are used to connect the General Purpose Transceiver (GPT) to one or more transducers. The following transducer types may be used:

- Single frequency, split beam

→ *The plug housing is shown on page 79.*

For the majority of the transducers, the cables are supplied from the manufacturer. These are normally physically fastened to the transducer.

Note

*The distance between the General Purpose Transceiver (GPT) and the transducer(s) must be as short as possible to avoid interference and noise.*

If the distance between the transducer and the transceiver exceeds the length of the cable, a junction box must be used. The cable between the junction box and the transceiver must then be supplied by Simrad, and this must be the same type as used on the transducer(s).

Note

*All transducer cables must be run in steel conduits. Use flexible conduit close to the transceiver.*

Note

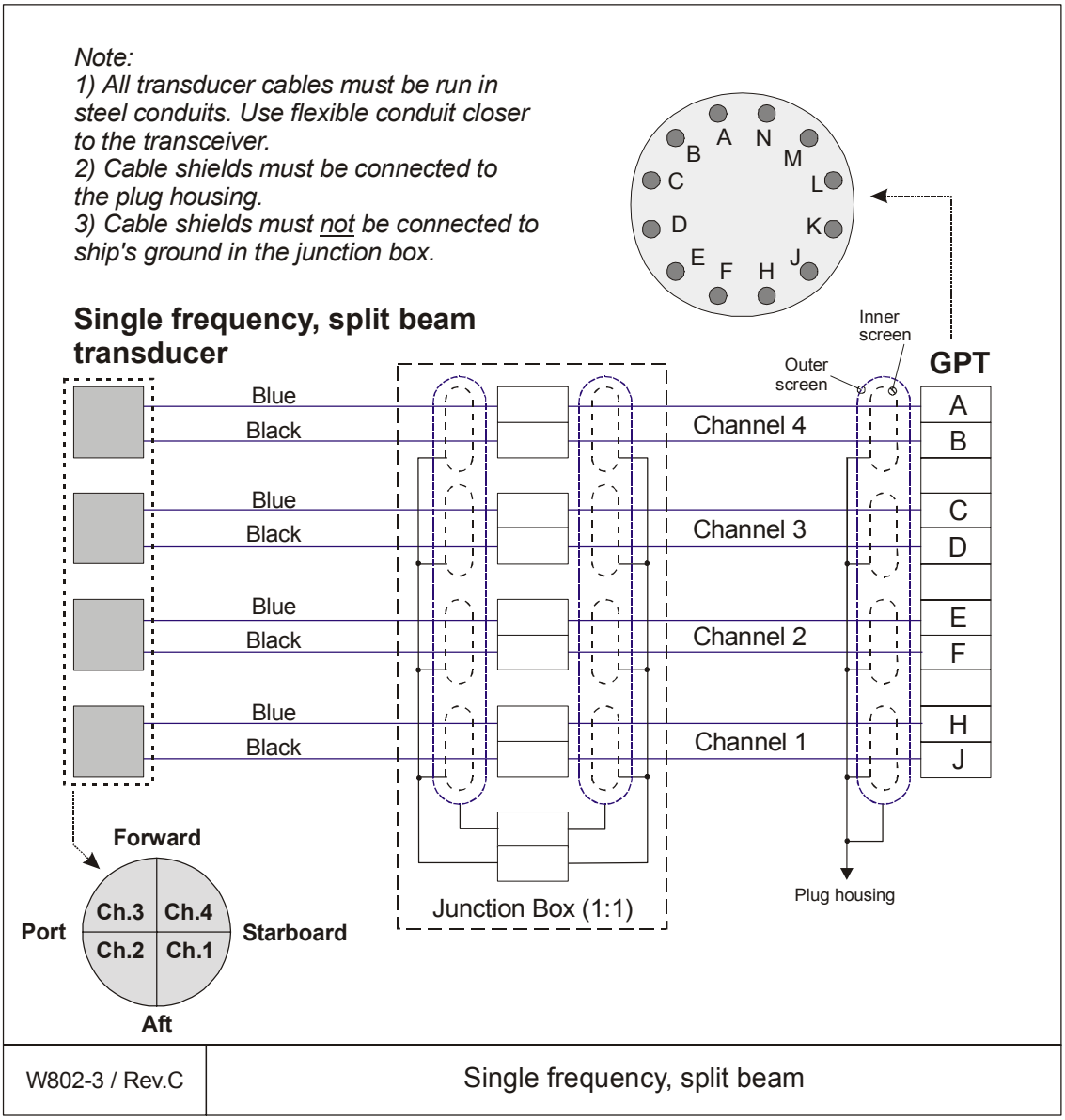
*Cable shields must be connected to the plug housing. The shields must not be connected to ship's ground anywhere between the transducer and the plug on the transceiver.*

→ *The termination of the cable shielding is shown on page 79.*

Observe the cabling diagrams.

## Single frequency, split beam

The drawing shows how to connect a single frequency, split beam transducer to the system.




| W802-3 / Rev.C | Single frequency, split beam |
|---|---|

| | |
|---|---|
| Conductors | 4 x 2 x N mm2 |
| Screen | Overall braided |
| Voltage | 600 V |
| Max.diameter | N/A |

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 $mm^2$. Special transducer cable is available from Simrad.

### Cable colours on split beam transducers

Note that the cables from the transducer may be supplied in different colours. The following colours may be used:

| Channel | Shown in W802-3 | Alt.A | Alt B |
|---|---|---|---|
| 4 | BL | BK | BN |
| 4 | BK | WH | WH |
| 3 | BL | BK | GN |
| 3 | BK | WH | WH |
| 2 | BL | BK | O |
| 2 | BK | WH | WH |
| 1 | BL | BK | BL |
| 1 | BK | WH | WH |

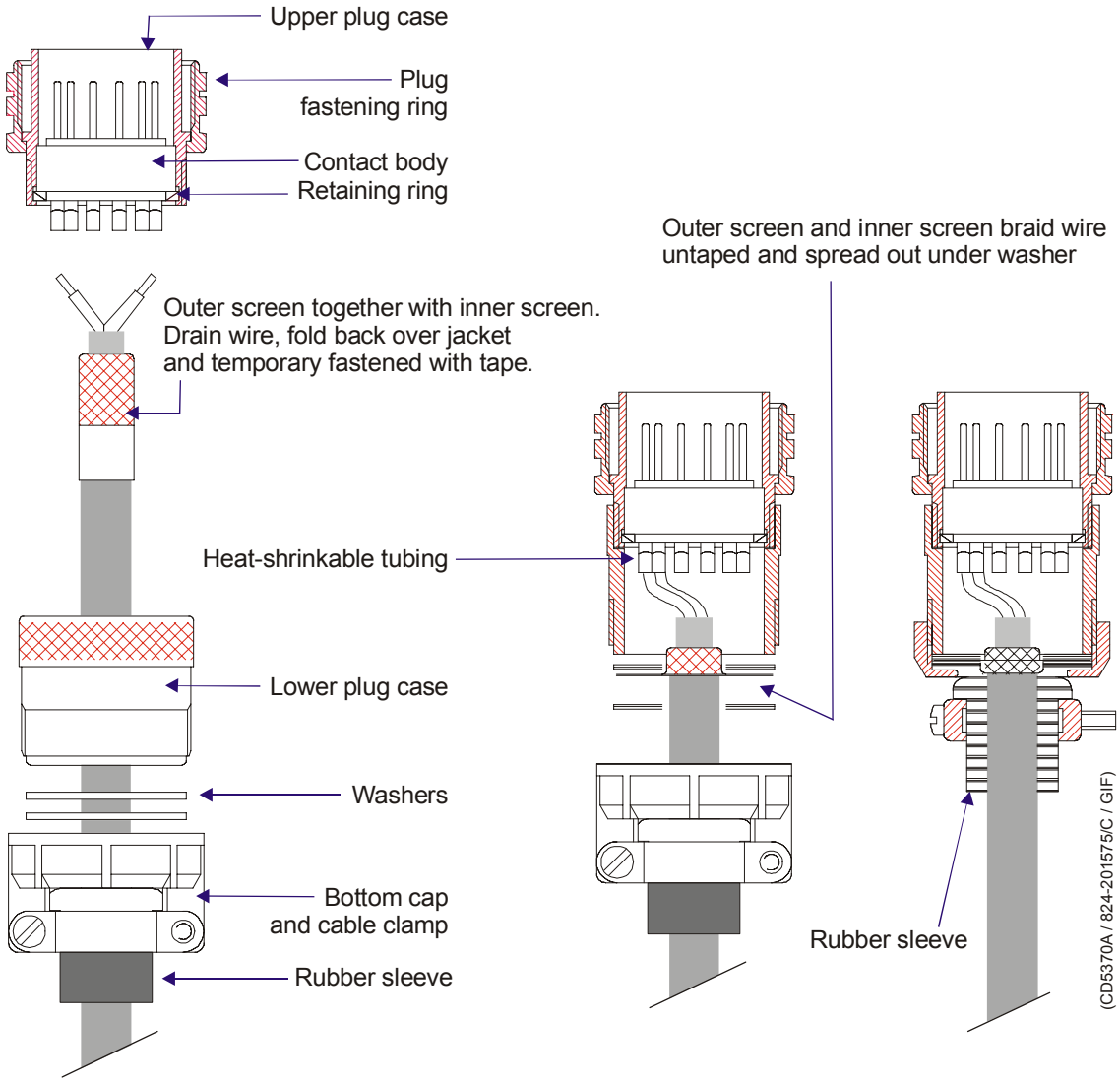



*Figure 25 GPT Plug connection, transducer*

## 4.6 Basic cabling requirements

### Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays. The only exception to this rule is over the final short distance (max. 0.5 metre) as the cables run into the cabinets/units to which they are connected. These short unsupported lengths are to allow the cabinets to move on their shock mounts, and to allow maintenance and replacements.

- Wherever possible, cable trays must be straight, accessible and placed so as to avoid possible contamination by condensation and dripping liquids (oil, etc.). They must be installed remote from sources of heat, and must be protected against physical damage. Suitable shields must be provided where cables are installed in the vicinity of heat sources.
- Unless it is absolutely unavoidable, cables should not be installed across the vessel's expansion joints. If the situation is unavoidable, a loop of cable having a length proportional to the possible expansion of the joint must be provided. The minimum internal radius of the loop must be at least twelve times the external diameter of the cable.
- Where a service requires duplicate supply lines, the cables must follow separate paths through the vessel whenever possible.
- Signal cables must not be installed in the same cable tray or conduit as high-power cables.
- Cables containing insulation materials with different maximum-rated conductor temperatures should not be bunched together (that is, in a common clip, gland, conduit or duct). When this is impractical, the cables must be carefully bunched such that the maximum temperature expected in any cable in the bunch is within the specifications of the lowest-rated cable.
- Cables with protective coverings which may damage other cables should not be bunched together with other cables.
- Cables having a copper sheath or braiding must be installed in such a way that galvanic corrosion by contact with other metals is prevented.
- To allow for future expansion of the system, all cables should be allocated spare conductor pairs. Also, space within the vessel should be set aside for the installation of extra cables.

### Radio Frequency interference

All cables that are to be permanently installed within 9 m (30 ft) of any source of Radio Frequency (RF) interference such as a transmitter aerial system or radio cabin, must, unless shielded by a metal deck or bulkhead, be adequately screened by sheathing, braiding or other suitable material. In such a situation flexible cables should be screened wherever possible.

It is important that cables, other than those supplying services to the equipment installed in a radio room, are not installed through a radio room. Cables which must pass through a radio room must be screened by a continuous metal conduit or trunking which must be bonded to the screening of the radio room at its points of entry and exit.

### Physical protection

Cables exposed to the risk of physical damage must be enclosed in a steel conduit or protected by a metal casing unless the cable's covering (e.g. armour or sheath) is sufficient to protect it from the damage risk.

Cables exposed to an exceptional risk of mechanical damage (for example in holds, storage-spaces and cargo-spaces) must be protected by a suitable casing or conduit, even when armoured, if the cable covering does not guarantee sufficient protection for the cables.

Metallic materials used for the physical protection of cables must be suitably protected against corrosion.

### Grounding

All metallic cable coverings (armour, lead sheath etc.) must be electrically connected to the vessel's hull at both ends except in the case of final sub-circuits where they should be connected at the supply end only.

Grounding connections should be made using a conductor which has a cross-sectional area related to the current rating of the cable, or with a metal clamp which grips the metallic covering of the cable and is bonded to the hull of the vessel. These cable coverings may also be grounded by means of glands specially intended for this purpose and designed to ensure a good earth connection. The glands used must be firmly attached to, and in good electrical contact with, a metal structure grounded in accordance with these recommendations.

Electrical continuity must be ensured along the entire length of all cable coverings, particularly at joints and tappings. In no case should the lead-sheathing of cables be used as the only means of grounding cables or units.

Metallic casings, pipes and conduits must be grounded, and when fitted with joints these must be mechanically and electrically grounded.

### Cable connections

All cable connections are shown on the applicable cable plan and interconnection diagrams.

Where the cable plan shows cable connections outside an equipment box outline, the connections are to be made to a plug or socket which suits the plug or socket on that particular item of equipment.

Where two cables are connected in series via a junction box or terminal block, the screens of both cables must be connected together but not grounded.

### Cable terminations

Care must be taken to ensure that the correct terminations are used for all cable conductors, especially those that are to be connected to terminal blocks. In this case, crimped sleeve-terminations must be fitted to prevent the conductor core from fraying and making a bad connection with the terminal block. It is also of the utmost importance that where crimped terminations are used, the correct size of crimp and crimping tool are used. In addition, each cable conductor must have a minimum of 15 cm slack (service loop) left before its termination is fitted.

### Cable identification

Cable identification codes corresponding to the cable number shown in the cable plan must be attached to each of the external cables. These identification codes should be positioned on the cable in such a way that they are readily visible after all panels have been fitted. In addition, each cable conductor should be marked with the terminal board number or socket to which it is connected.

## 4.7 Cable gland assembly procedure

### Purpose

Cable glands are used whenever a cable passes through a water-tight bulkhead or into a cabinet, to seal the opening through which the cable passes and to protect the cable from abrasion on the edges of the hole. Follow the guidelines detailed here when installing cables through cable glands.

Note *There are many different types of cable gland on the market. This procedure describes the types used (now and previously) as standard in the units manufactured by Simrad. The cable glands are not supplied with the system.*

Even though the cabinets from Simrad may be prepared for specific types, the installation shipyard will be responsible for selecting cable gland types and installing them.

Note *The screen in transducer cables must never be connected to ship's ground in the cable glands!*

### General procedure

**1** Ensure all the cables to be connected are completely isolated from any power sources.

- I.e. Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

**2** Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

Note *A **minimum** of 5 cm (recommended 5 - 10 cm) of slack cable must be allowed, both inside and outside the cabinet, when installing cables. This is to allow for vibration damping, maintenance and measurement errors. Always double-check your measurements before taking any irreversible actions.*

**3** Depending on whether the cable has already been installed in conduits, either.

**a** (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

**b** (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

**4** Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

**5** Leaving an appropriate length of the screen exposed from the insulation, cut off the remainder.

## Securing and terminating the cables

**1** Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.

**2** Secure the cable within the cabinet using cable clips.

**3** Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands. Once all the cables have been fitted:

**4** Check the cabinet to ensure all tools and rubbish are removed, then close the cabinet door.

Once all the system cables are connected and checked:

**5** Take the appropriate safety measures, then replace the fuses and apply power to the system.

**6** Perform a system test to ensure the installation has been conducted successfully.

## Multi-diameter modules

Multi-diameter cable glands are now available from several sources, and these types are becoming increasingly popular due to ease of use. Only a brief description of the system will be presented her, further information with technical specifications and installation descriptions must be obtained from the manufacturer(s).

The illustrations and examples here are from the following manufacturer:

```
Roxtec AB
Bx 540
S-371 23 Karlskrona, SWEDEN
http://www.roxtec.se
```

To use this sealing system, you first need to cut an opening in the wall (bulkhead, cabinet etc) you wish to penetrate, and this hole must be sized to fit one of the standard rectangular or circular frames provided by the manufacturer.

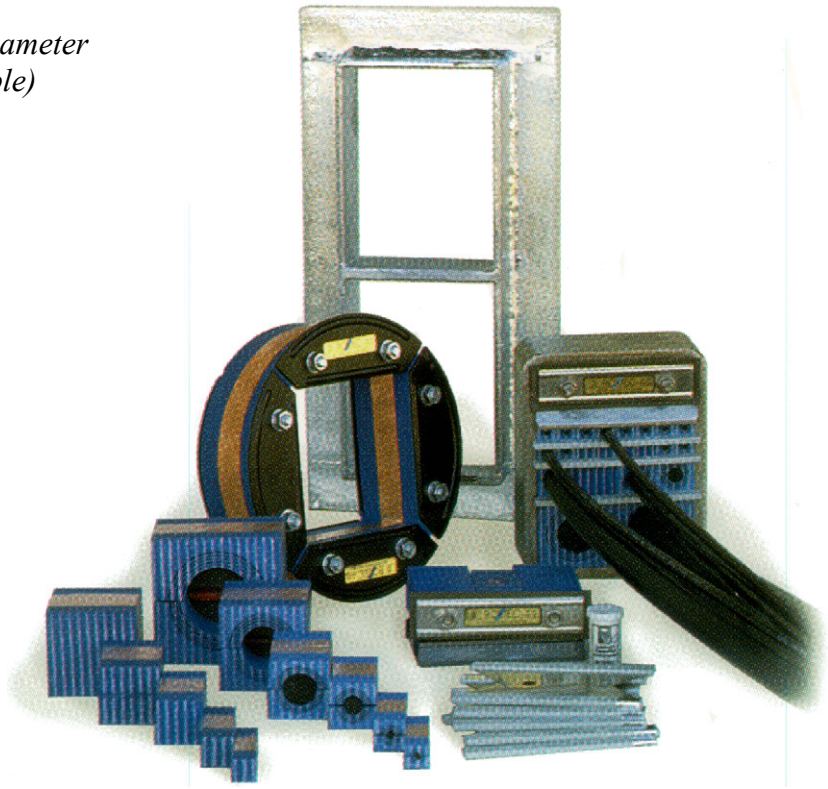


*Figure 26 Multi-diameter modules (example)*

After the frame has been mounted, the cables can be pulled through, and in most cases the opening will be large enough even to accept the plugs on the cables.

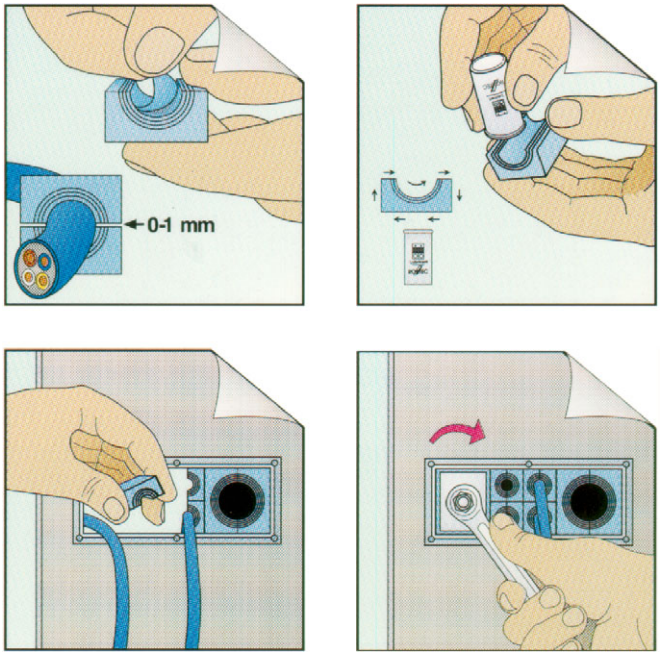



*Figure 27 Multi-diameter system - Principal procedure*

Once the cables are through, each cable is secured with a square module, which is adjusted to fit the cable's outer diameter.

When the required number of modules are installed, the assembly is tightened with a compression unit.

This system is available with a large number of various modules and compression units, and it will also comply to screening and EMC requirements.

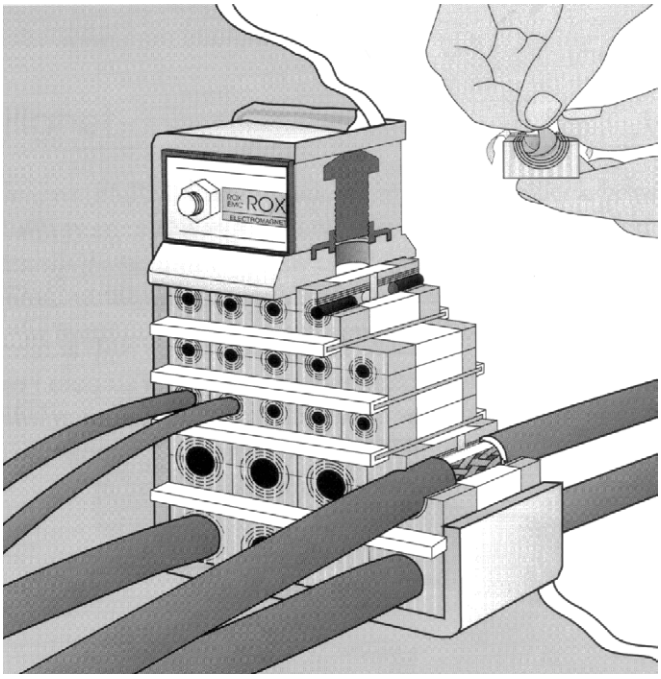



*Figure 28 Multi-diameter system - The finishied assembly*

## Standard type

**1** Ensure that all the cables to be connected, are completely isolated from any power sources.

- Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

**2** Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

**3** Slacken and remove the compression nut from the cable gland, and extract the compression seal and the screen collar from the body of the gland.

Note

*A **minimum** of 5 cm (recommended 5 - 10 cm) of slack cable must be allowed, both inside and outside the cabinet, when installing cables. This is to allow for vibration damping, maintenance and measurement errors. Always double-check your measurements before taking any irreversible actions.*

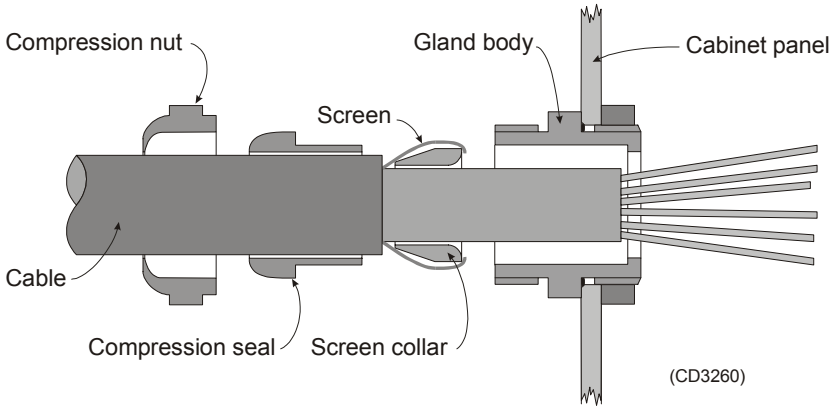



*Figure 29 Standard cable gland assembly*

**4** Depending on whether the cable has already been installed in conduits, either:

**c** (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

**d** (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

**5** Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

**6** Leaving 12 mm of the screen exposed from the insulation, cut off the remainder.

**7** Taking care not to damage the screening, slide the compression nut (smallest diameter first) over the cable and onto the intact insulation.

**8** Taking care not to damage the screening, slide the compression seal (rounded end first) over the cable and onto the intact insulation.

**9** Slide the screen collar (narrow end first) onto the cable and fit it underneath the screen. Slide it as close to the intact outer insulation as possible.

**10** If the screen extends beyond the "flat" end of the screen collar, fold any excess length over the end of the collar such that the screen will be gripped between the collar and the gland body when the parts are assembled.

**11** Carefully thread the cable through the gland body till the screen collar is tight into the gland body.

**12** Slide the compression seal into the gland body till the shoulder is hard up against the gland body.

**13** Slide the compression nut over the compression seal and engage the threads.

**14** While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

**15** Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.

**16** Secure the cable within the cabinet using cable clips.

**17** Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands.
Once all the cables have been fitted:

**18** Check the cabinet to ensure all tools and rubbish are removed, then close the cabinet door.

Once all the system cables are connected and checked:

**19** Take the appropriate safety measures, then replace the fuses and apply power to the system.

**20** Perform a system test to ensure the installation has been conducted successfully.

## Additional type 1 (842-093878)

**1** Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

**2** Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 30.*

**3** Bend the screen over the rubber gasket.

**4** Push the rubber gasket and the two metal washers carefully into the cable gland body.

**5** While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

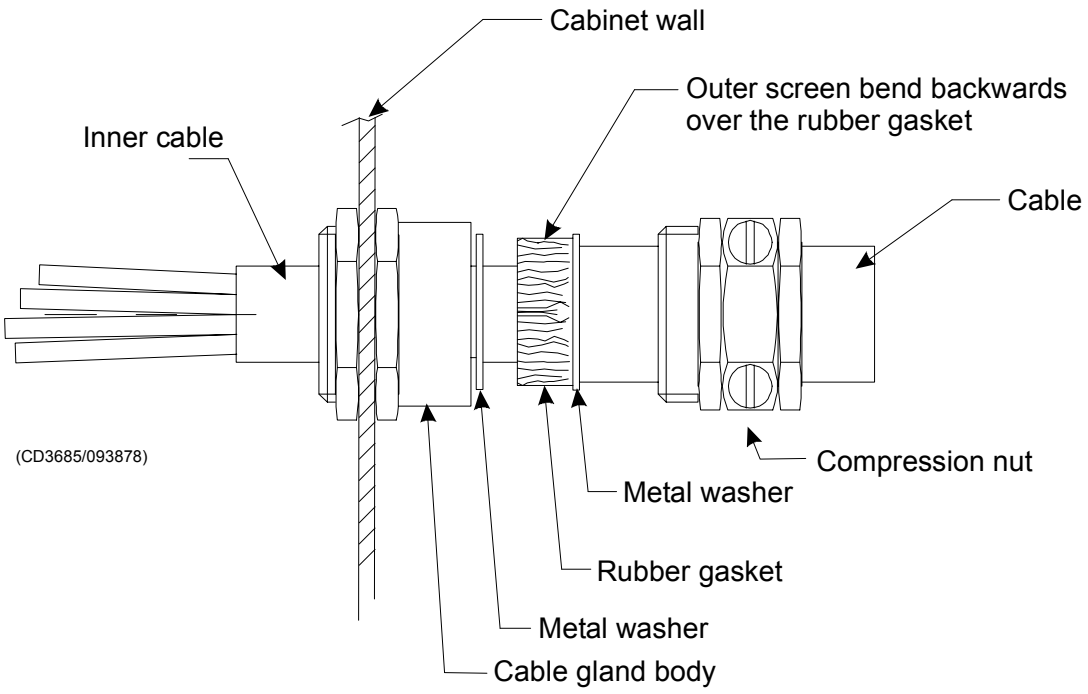



*Figure 30 Cable gland, type 1 (842-093878)*

## Additional type 2 (541-093642)

**1** Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

**2** Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 31.*

**3** Bend the screen over the compression cone.

**4** Push the compression conne, the washers and the rubber sealing washer into the cable gland body.

**5** Close the mounting nut.

**6** Close and tighten the compression nut on the other side of the cabinet wall.

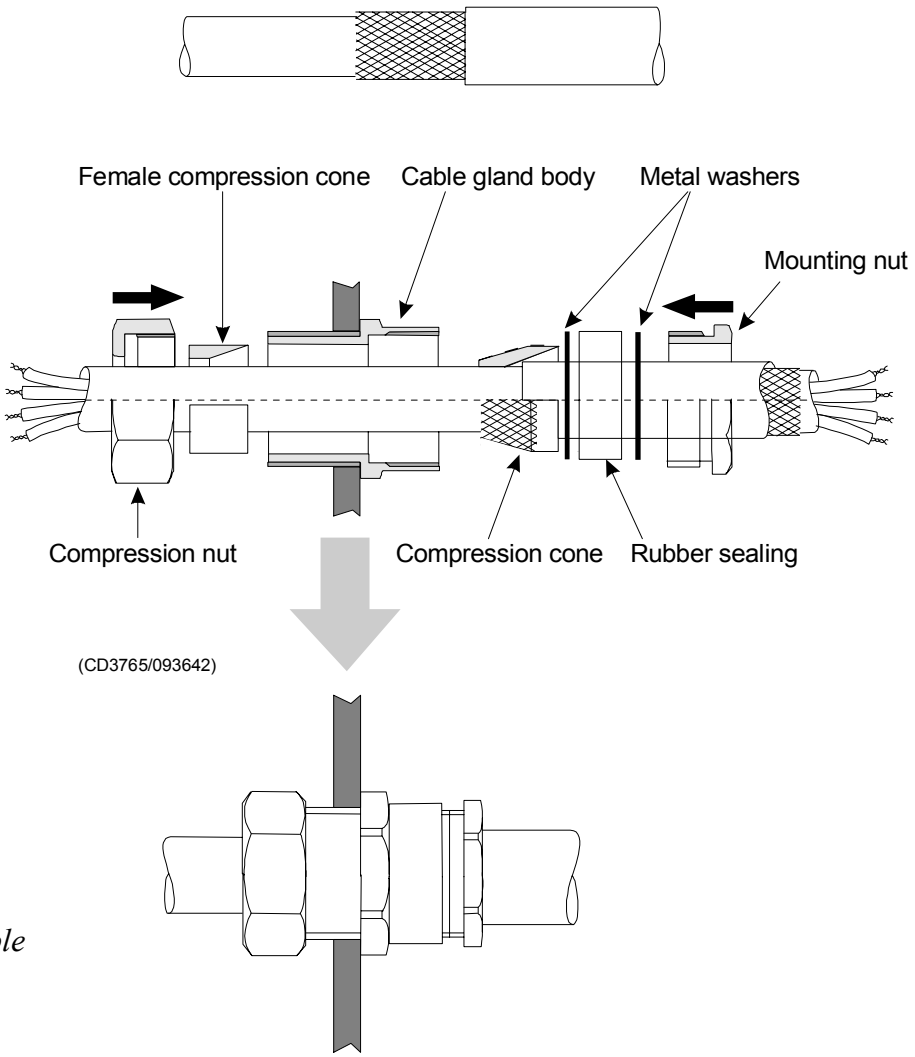



*Figure 31 Cable gland, type 2 (541-093642)*

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